FRIDAY, FEBRUARY 23, 1883.

THE BALFOUR MEMORIAL.

THE death of Francis Maitland Balfour last July was felt by many as a heavier blow to biological science than the loss of Darwin. The immortal master had nearly finished his work: Balfour's had but commenced. There was therefore added to the emotion of personal bereavement the perhaps less poignant but deeper grief due to the fact that science had sustained, through Balfour's early death, an almost irreparable loss. His work had already yielded such rich fruits that we hardly knew how to put a limit to what we might expect from him in the future. His genius, patience, knowledge, technical skill, and critical judgment were so apparent in his published works, that when he died aged but thirty-one years, he was already recognized throughout the civilized world as an eminent authority on morphological questions. All young English biologists looked upon him as the undisputed future leader of morphological science in their country. The feelings towards him of older men have been expressed by Professor Huxley: "It is no exaggeration to say, that to my eyes, and to those, I take it, of many of my age, Professor Balfour seemed to be like that Lycidas of whom Milton spoke: —

'Dead ere his prime,
Young Lycidas, and hath not left his peer.'"

Of the beauty of Balfour's character we cannot here speak: its remembrance will ever remain a cherished and inspiring possession of every one who knew him.

It was impossible that the death of such a man should not be followed by some effort on the part of his contemporaries and fellow-workers in science to express the esteem in which they held him and his work. We desire to call attention to the admirable form which the Balfour Memorial is to take; namely, the establishment of a permanent fund, the income of which is to be used exclusively for the promotion of biological research.

The Balfour Memorial took definite shape at a meeting held in the University of Cambridge last October, attended and addressed not only by the leading biologists of Great Britain, but by distinguished theologians, classical scholars, chemists, and mathematicians. This co-operation of leaders in so many lines of thought was a most striking testimony to the wide-spread regard felt for Balfour's personality, and to the value attached to his influence by many who were not able to appreciate the technical importance of his morphological discoveries.

At the meeting it was decided to found a Balfour Memorial, and that this should take the form of an endowment fund "for the promotion of biological research, especially in morphology:" also, that the income yielded by the 'Balfour Fund' should be employed, (1) in the payment of £200 a year to a young biologist for his support while engaged in morphological research; and (2) in occasional grants to the Balfour student, or other biologists, for the promotion of research, — as, for example, by providing the means of visiting parts of the world especially suited for the prosecution of investigations on hand, or by supplying expensive apparatus or rare specimens. It was also decided unanimously, that, though the fund should be in some way closely connected with Balfour's own university, yet others than members of the University of Cambridge should be eligible as Balfour students.

We can conceive of no more suitable form for the Balfour Memorial than that selected. As the work of him whom it commemorates was cosmopolitan, so are to be the benefits of the fund. By perpetuating Balfour's name through all future time in connection with biological research, it appeals to the sympathy of all who knew him or his work. By affording support for a year or two to young men qualified to advance knowledge, it will, through generations to come, save for science many, who, without such help while winning their spurs, would have been forced into a professional or business career. Thus not only will science be advanced, but Balfour's work passed on from hand to hand; so that the increase of knowledge which we had hoped for from him

will, in the course of time, come to us through the work of successive 'Balfour students.'

The sum already subscribed in England is more than sufficient to provide for the Balfour studentship: but a memorial to such a man and for such objects should be international; and we are glad to learn that a representative committee of American naturalists, with Mr. Alexander Agassiz at its head, is being organized for the purpose of obtaining subscriptions to the Balfour fund. Few scientific men in this country are in a position to contribute large sums; but we trust that all American biologists will give something, whether they be investigators, teachers, or students. A general subscription from naturalists on this side of the Atlantic would be a most graceful testimony to the esteem in which Balfour's character and work are held by us; and would at the same time express our approval of the idea to make the monument of an eminent scientist not a bronze or marble statue, but a permanent endowment for the advancement of knowledge.

REARING OYSTERS FROM ARTIFICIALLY IMPREGNATED EGGS.

DURING the past three years the writer has been engaged upon the investigation of this subject, with the view of reaching some practical results which would be available in the hands of oyster-culturists. Until last year his efforts under the auspices of the U.S. fish commission had been comparatively fruitless and unsatisfactory. In July and August last, in association with Col. M. McDonald, the experimental work was resumed at St. Jerome's Creek, St. Mary's County, Maryland. Col. McDonald devised a simple combination of glass apparatus, consisting of a series of jars connected together with rubber tubing, somewhat in the manner of a series of Wolff's bottles, with an open glass aquarium at a higher level as a feeder, or reservoir, while the last jar of the series discharged into a similar cylindrical aquarium standing on the floor. The sea-water introduced into this contrivance was carefully filtered through cotton-wool, to remove all sediment and foreign organisms. The circulation was maintained in this contrivance by baling the water from the lower into the upper aquarium; the water passing continually through the intervening series of jars, which were, in effect, simply enlarged portions of the siphon-tube passing from the upper to the lower aquarium. No difficulty was experienced in keeping the water in this apparatus fresh and sweet without renewal.

On the 23d of July a batch of oyster-eggs was introduced into this apparatus, impregnated by a method to be hereafter described. On the 24th, and just about twenty-four hours after impregnation had taken place, an inspection of the transparent sides of the jars and aquaria was made; and to our great surprise we found immense numbers of embryos with the valves of the larval shell covering the sides of the body, and adherent to the inner surfaces of the glass vessels. In some places upwards of twenty-five might have been counted to the square inch. Every available part of the surface of the vessels was, however, more or less affected by these affixed embryos. Some of the jars were then taken from the closed circuit, and a continuous current passed through them, which it was found did not dislodge the embryos; but in two to three days more it was found that most had died or been detached, even in the portion of the apparatus not affected by a continuous current of fresh sea-water. The gratifying result which we had anticipated at the beginning of our experiment was, however, not realized, except in so far as it determined that fixation of the embryos took place at an early period under favorable conditions, or in about twenty-four hours, and that they might be reared from artificially fertilized ova. Efforts to repeat our first successful experiment failed, owing, probably, to the high temperature then prevailing.

The next advance made was when the writer hit upon a physical test by means of which the sexes of the spawning adults can be instantly determined by the most ignorant person. It was found, that if the ova were squeezed from the ovary, and dropped into sea-water in a glass dish resting on a dark ground, they would break up into a distinctly granular cloud; while the milt would not so readily break up, but would tend to mix slowly with the water as a milky substance, the particles of which were not perceptible to the naked eye, and, if stirred about in the water, would not break up at once, but be drawn out into wisps and streaks resembling in miniature cirrus or mare's-tail clouds. This test was an infallible guide; so much so, that a pocket-lens was found to be of no advantage, as we had formerly supposed. We also found, that if the eggs did not separate at once, when dropped into the water, they were not so mature as they should be.

Another important improvement was also in-

troduced by the writer for extracting the eggs and milt from the adults for spawning purposes. This consisted in applying essentially the same method for the extraction of the eggs as is used in spawning fish artificially; thereby avoiding the admixture of foreign matters, and fragments of the other tissues of the animal, such as occurs when the ovary is cut out, and chopped up into fragments in water. A very little experience will enable a person to find the ovary or spermary on the sides of the body of the animal when one valve is removed. Removing the mantle below and in front of the heart-chamber, its principal ducts will be exposed; and these may be traced backwards on either side of the ventral process of the body-mass to below the muscle, where the process juts into the suprabranchial chamber with its apex reaching to the commencement of the cloaca. When the spawn is abundant, the ducts are usually gorged, and look like prominent veins distended with a creamy substance.

To remove the generative products without cutting or lacerating the reproductive organs, one should be provided with a medicine-dropper or short pipette with a curved tip and a compressible rubber bulb at top. With the curved point of the pipette, the ducts of the reproductive organ are gently and firmly stroked in the direction of the external opening from before backwards. This, if properly done, will force out the eggs or the milt in a stream from the genital opening of the same side; when the pipette may be applied to suck up the extruded spawn, and drop it into water without the admixture of any deleterious foreign matters whatever. If the soft parts of the oyster have been left attached to the one valve, which I have found to be most convenient in practice, the other side of the animal may be treated in the same way, as the reproductive organ has an opening on either side of the body. To do this the head end of the animal, next the hinge, is simply thrown back over the adductor, the mantle cut open, and the spawn pressed out of the ducts of the under side as before.

By the foregoing method, which is much neater and more cleanly than any other, the best spawn is obtained; and it is often possible to impregnate fully ninety per cent of the eggs taken. When eggs so treated are placed under the microscope, comparatively few injured ones will be observed; at any rate, the result will be vastly more satisfactory than if the animal is crushed or chopped up in order to get the spawn. Many billions of eggs might be fertilized in a day by this plan.

As a result of the experience with the fixation of the embryos resulting from the artificially fertilized eggs, as described at the outset, it was determined to investigate the mode of fixation to learn if there was any uniformity about it. I now believe that the fixation of the fry is accomplished by the border of the larval mantle, the existence of byssal organs being doubtful. The oldest larval shells of artificially reared embryos have the hinges of the valves truncated and without beaks or umbos; while the fry on the eve of conversion into spat has a distinct beak to each of its valves, which projects anteriorly beyond the hinge-line. The valves, at this time, are very ventricose, quite symmetrical, and similar to Pisidium in form, or in the most marked contrast, in respect of shape, with the irregularity of the older spat and adult.

When a large number of very young natural spat is examined on their attachments, it will be found, that in every case the apex of the umbo of both the valves of the larval shell are turned towards the left if the hinge end is directed towards the north. It is therefore clear, that when the young attach themselves, they do so constantly by one and invariably the same side. Upon examining spat which has just begun to form a shelly attachment, we find this to begin at the border of the larval shell, and to grow outwards; the hinge being continued for a time laterally or on a line with that of the larval shell. We may also note, that the distal free border of the lower valve is the only part of the fry shell which comes into direct contact with the object to which attachment occurs; and that the hinge end of the larval or fry shell is directed somewhat upwards, the line of junction of the valves having at first formed an angle of nearly thirty degrees with the plane of the surface to which fixation occurred. This condition of things is so invariable that it may be regarded as universally the case. How does the fixation occur? A byssus at most would only serve for temporary anchorage; and we find, that as soon as the first calcareous deposits are formed to build the asymmetrical valves of the spat, the lower valve of the latter is for the first time glued down by the conchioline or periostracum covering it externally, and that it often continues to be so affixed until it is nearly two inches in diameter. After this the lower valve of the spat becomes free, and the free margin of the shell begins to be bent upwards. The valves of the symmetrical fry are also laminar and homogeneous in microscopic structure; while the very first layers of

calcic carbonate deposited to form the spat shell are prismatic and of a wholly different microscopic appearance from that of the fry. The facts presented above prove beyond a doubt, that it is the mantle border of the fry which is the effective agent in achieving firm fixation, whatever may be the importance of a temporary or larval byssus.

This was an interesting and important point to determine, on account of its practical relation to the artificial rearing of the American oyster (Ostraea virginica). But with the foregoing comparatively meagre results we may say, that our success in the artificial culture has ended; and, were it not for the highly encouraging recent reports from France, our efforts might have rested here. The stimulus which has provoked the investigations recently undertaken abroad was, however, probably Dr. W. K. Brooks's success with the American oyster in 1879, and his demonstration of its unisexuality.

The remarkable success of M. Bouchon-Brandely in rearing spat from the artificially fertilized ova of O. angulata at Verdon in France, as reported in the *Annals and magazine of natural history* for October, 1882, and his still later reports to the minister of marine of France in the *Journal officiel de la république française*, are of the greatest moment as applied to practical oyster-culture. M. Brandely, after determining that O. angulata was unisexual like the American species, conceived the idea of rearing the spawn by artificial means. In order to do this, two adjoining oyster claires, or ponds, fed by the tides were arranged at Verdon; the one acting as a reservoir from which the fresh sea-water (brackish) was drawn through a tube, provided with a filter consisting of a sponge at either end, into the lower experimental claire. The water percolated out of the latter through a bed of fine sand; in this way the embryonized ova placed in this pond were kept from escaping. Fertilized eggs were then put into the experimental pond from day to day, while a number of collectors, or tiles, were at once submerged in the same. In somewhat more than a month, success had attended his experiments; and in the course of further experiment still greater success was attained when about four thousand spat had been found affixed to a single tile under circumstances which admitted of no doubt as to their having been the product of the artificially impregnated eggs placed in confinement in their vicinity. It was found, moreover, that the artificially fertilized eggs had actually developed into spat in the closed claire a month before any had made their appearance on the thousands of tiles placed on the natural banks in the Gironde.

From a personal investigation of the anatomy of O. angulata, we can affirm that it is remarkably similar to O. virginica in the structure of the generative organs, and that there is no reason why as great success should not attend the culture of that species by the same apparently very practicable means. It remains to be seen, however, what proportion of the artificially reared spat will reach the adult condition. With an abiding faith, however, in the final achievement of the solution of the question of the artificial culture of the American oyster, which will soon become a positive necessity to its culture, I think it not improbable that another season's work will conclude the required preliminary research, and realize for us all the success we could hope for.

J. A. Ryder.

THE MAPPEMONDE OF SEBASTIAN CABOT.

The library of Harvard College, in Gore Hall, has recently been enriched with a photographic facsimile of the large map of the world in the national library in Paris, known as the map of Sebastian Cabot. This interesting memorial was discovered in Germany about the year 1844, in the house of a Bavarian curate, and, through the good offices of M. de Martius, was in that year purchased for the Paris library. It is a large elliptical *mappemonde*, engraved on copper, 1 m. 48 cm. in width, 1 m. 11 cm. in height. Along each side of the map, that is to say, outside the circle, is a table 30 cm. in width; the first, on the left, inscribed at the head, Tabula Prima, and that on the right, Tabula Secunda. On these tables are seventeen *legendes*, or inscriptions, in duplicate, — that is to say, in Spanish and in Latin, — printed, and pasted on the map. Each legend in Latin immediately follows the Spanish original, and bears the same number. Besides these seventeen inscriptions, there are five others in Spanish which have no Latin *exemplairs*.

This ancient map, composed, as we shall see farther on, in the year 1544, while Cabot was yet living in Spain, contains geographical delineations of discoveries down to about that period. In representing the north-east coast of our continent, Newfoundland is laid down as a group of islands; and we easily recognize the river and bay of St. Lawrence,

Cape Breton, and the Isle of St. John. The west coast of America is delineated as far north as lat. 35°, California being drawn from the well-known chart made by the pilot Castillo in 1541. To the north of this, of course, is the unknown region; for nobody then knew certainly whether America and Asia were one continuous continent, or were divided by straits, and the conjectures of geographers were at variance.

But the interest in this map centres principally in its inscriptions; and, though the most of these contain little of value in a geographical or historical point of view, a few of them are of special significance. The seventeenth inscription, by turning it into English, reads as follows: —

"Sebastian Cabot, captain and pilot-major of his sacred imperial majesty, the emperor Don Carlos, the fifth of this name, and the king our lord, made this figure extended on a plane surface, in the year of the birth of our Saviour Jesus Christ, 1544, having drawn it by degrees of latitude and longitude, with the winds, as a sailing-chart, following partly Ptolemy and partly the modern discoveries, Spanish and Portuguese, and partly the discovery made by his father and himself: by it you may sail as by a sea-chart, having regard to the variation of the needle," etc.

Then follows a discussion relative to the variation of the needle, which Sebastian Cabot claimed to have first noticed. Here we have the declaration, that the map was made by Sebastian Cabot, pilot-major of the Emperor Charles V., and in the year 1544, at which time we know he was living in Spain and held that office. And this is accompanied by the statement, that, in making the map, he was guided by the discoveries of his father, John Cabot, and himself.

Inscription No. 8 reads thus: —

"This country was discovered by John Cabot, a Venetian, and Sebastian Cabot his son, in the year of our Lord Jesus Christ, MCCCCXCIV [1494], on the 24th of June in the morning, which land they called '*prima vista;*' and a large island adjacent to it they named the Island of St. John, because they discovered it on the same day," etc.

This is an important statement made or authorized by the alleged author of the map, said in the inscription No. 17 to be Sebastian Cabot; and, though the year of the discovery expressed is believed to be a typographical or a clerical error, the whole passage bears evidence of proceeding from Sebastian Cabot himself. The body of the map itself contains numerous inscriptions, some brief, and others of greater length, with references by numbers to the legends on the sides; so that these tables belong to and are a part of the map itself. The *prima vista* of legend No. 8, or '*prima tierra vista*,' that is, the land first seen by the Cabots, is inscribed on the map near the head of the delineation of Cape Breton.

Like many of the large maps of that period, a number of figures of men and animals, the supposed natives of the countries described, are introduced into the body of the map. Savages are at war with each other, and tigers and bears are roaming over the American continent; the Emperor of Tartary is depicted in state; and Prester John, holding a cross, is placed near the great lakes, the sources of the Nile. In the original map the figures are colored. The map has no name of engraver or publisher, or place of publication. One would naturally say it was published in Spain; but the policy of the government was opposed to the publication of maps which delineated their own possessions. Dr. Kohl thinks it was published in Germany or Belgium. In one corner of the map is depicted the double-headed eagle displayed on the arms of Germany.

I do not propose to discuss in this brief notice all the questions which have arisen, or which suggest themselves, respecting the genuineness and value of this map, but simply to describe it. It can be studied now by means of the photographic copies taken, as it never could be studied before from the position of the original in the national library in Paris.

We now know, from sources independent of this map, that John Cabot, in a single vessel from Bristol, discovered North America in the year 1497. His son Sebastian may have been with him. The expedition returned in about three months. In the following year, 1498, John Cabot sailed again with a larger number of vessels, and Sebastian no doubt went with him. They had not returned by the end of October. Nobody knows when they returned, and nobody knows what became of John Cabot. Sebastian returned, and lived fifty years after this second embarkation. He or his father, or both of them, made maps at the time, illustrating the voyage of discovery; but these are lost. Writers in the sixteenth century, before Hakluyt's time, often speak of Sebastian Cabot's maps (they never speak of John Cabot), but without describing them. Ortelius in 1570 had a copy of a map by Cabot engraved on copper, without the

name of the place or printer. Yet, forty years ago, no one, for two centuries and a half, had seen a copy of a map by Cabot. When, therefore, it was announced that the National library in Paris had found a Cabot map, a great interest was excited. The distinguished geographer, M. d'Avezac of Paris, wrote a description of it in the *Bulletin de la société de géographie* (4th ser. tome xiv. pp. 266–268); and M. Jomard produced a facsimile of it, without the inscriptions, for his great work, the *Monuments de la géographie*, 1842–1862. Geographers have been trying to study it ever since; but the inscriptions had never been copied, and it required a visit to Paris to inspect them. In the glass case in which the map was shown, it was scarcely accessible for study. Having occasion last winter to make a study of the Cabot voyages, I wrote to Paris to have a copy made for me of several of the inscriptions on this map, — the greater part of which in their Spanish form were nowhere accessible. The great charge for the work was explained by the difficulty of access to the map, of which I have spoken. About this time, being in consultation with the librarian of Harvard University, — Mr. Winsor, — he suggested the practicability of having a photograph made of the map and its inscriptions. As the Hon. Robert C. Winthrop, the president of the Massachusetts Historical Society, was about to sail for Europe, the matter was laid before him; and he readily entered into the plan, and, thanks to his kind intervention during a late visit to Paris, the work was accomplished, and the photograph is a great success. The skilful photographer employed by Mr. Winthrop was M. Sauvanaud, who made for him ten copies, which have been taken by different libraries and societies in this country, dividing the expense between them.

This map has a curious connection with other historical memorials of three hundred years ago, and an interesting piece of literary history might be made of it. I will state briefly some of the points of interest. Richard Hakluyt, the great collector of voyages and travels, in a folio volume published in 1589, called The principal navigations, etc., printed "An extract taken out of the map of Sebastian Cabot, cut by Clement Adams, concerning his discovery of the West Indias, which is to be seen in her Majesty's privy gallery at Westminster, and in many other ancient merchants' houses." The 'extract' which follows this heading is in Latin, and is in substance the same as legend No. 8 on the Cabot map in Paris, from which I have made a quotation above, relating to the discovery of unknown lands. I say it is in substance the same; but the grammatical construction is quite different, indeed, so very unlike that I suggested some years ago that the Latin of the Paris map and the Latin of Clement Adams, or that which he copied, were independent translations from a Spanish original. Now, here we see another Cabot map in London, from which Clement Adams, a learned schoolmaster, made copies, with the same legends upon it in Spanish, or in Latin, or in both; if in Latin, quite different from that on the Paris map. Possibly it had only the legends in Spanish, and Adams made his own independent translation, as suggested above.

Again, in 1594, — second edition, 1599; third edition, 1606, — there was published a rare and curious volume, edited by a German traveller, Nathan Kochhaf, or, as he was called by his Latin name, Chytraeus. He was in England in 1565, picking up whatever of antique and curious legends and monumental inscriptions he could find for his book; and while apparently at Oxford, he saw a document, with some geographical tables, containing several inscriptions in not very elegant Latin, he says, but which, on account of the value of the matter contained in them, he copied and printed in his volume, filling twenty-two pages of this book. They are wholly in Latin, and they correspond substantially with the Latin inscriptions on the sides of the Cabot map in Paris. There is this difference: The inscriptions here are but nineteen in number, while on the Paris map there are twenty-two, five of them in Spanish only. Legend No. 17, which I have quoted above in part from the Paris map, has the date 1549 inserted as the year in which the map to which the inscriptions belonged was composed; instead of 1544, as on the Paris map. This which Chytraeus saw may be a second edition of the Paris map, made after Cabot had returned to England. So here, again, we have another Cabot map to be added to our cartographical bureaux, along with that of Clement Adams and the map from which he made his copies, which were hanging up, in Hakluyt's time, 'in many ancient merchants' houses,' — all of which we must class with the *desiderata*.

I have spoken of the volume of Chytraeus, which contains substantially the legends as on the Paris map in Latin. The language in which the legends were originally written was Spanish; and on the Paris map, as I have already said, they appear in Spanish as well

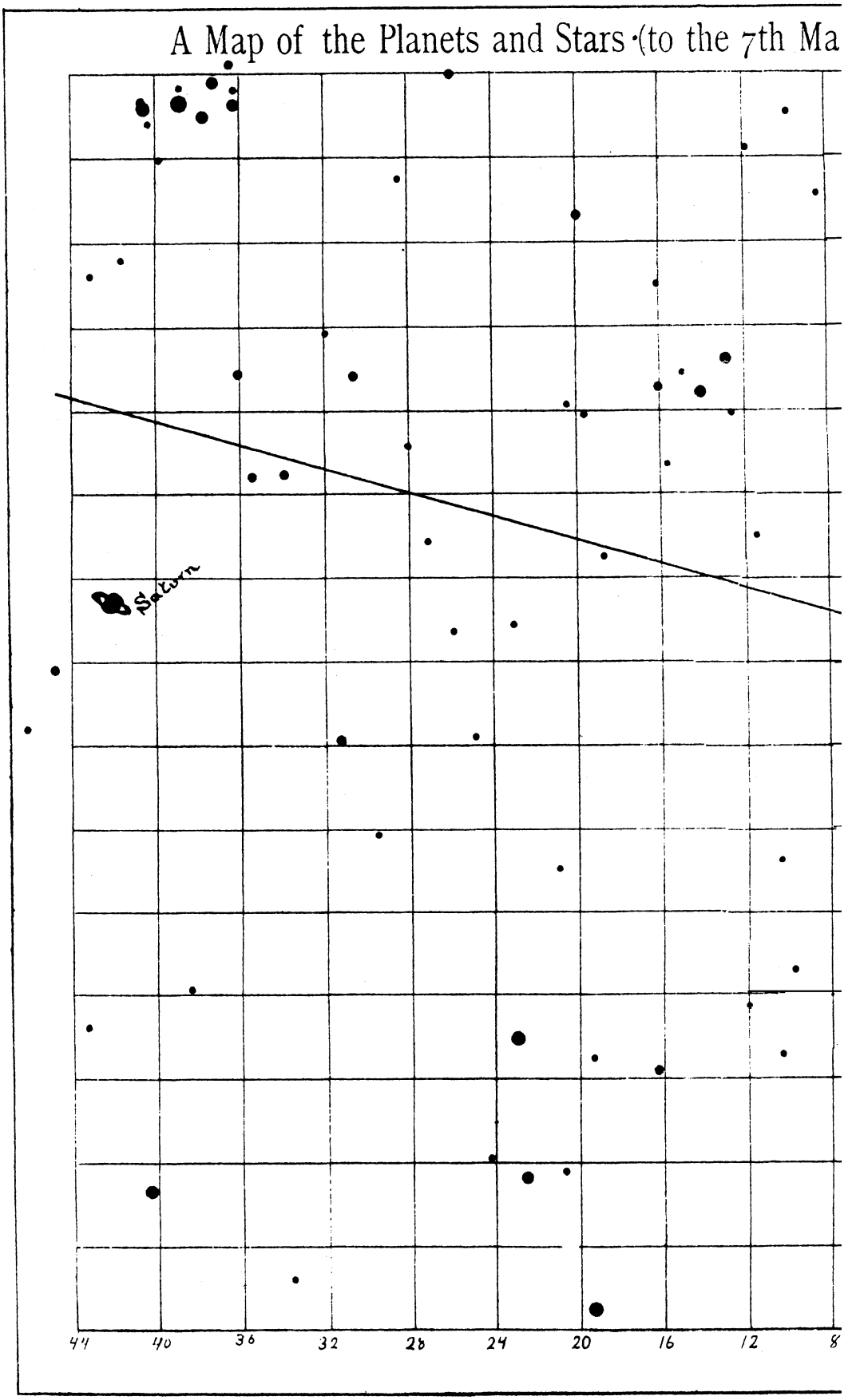
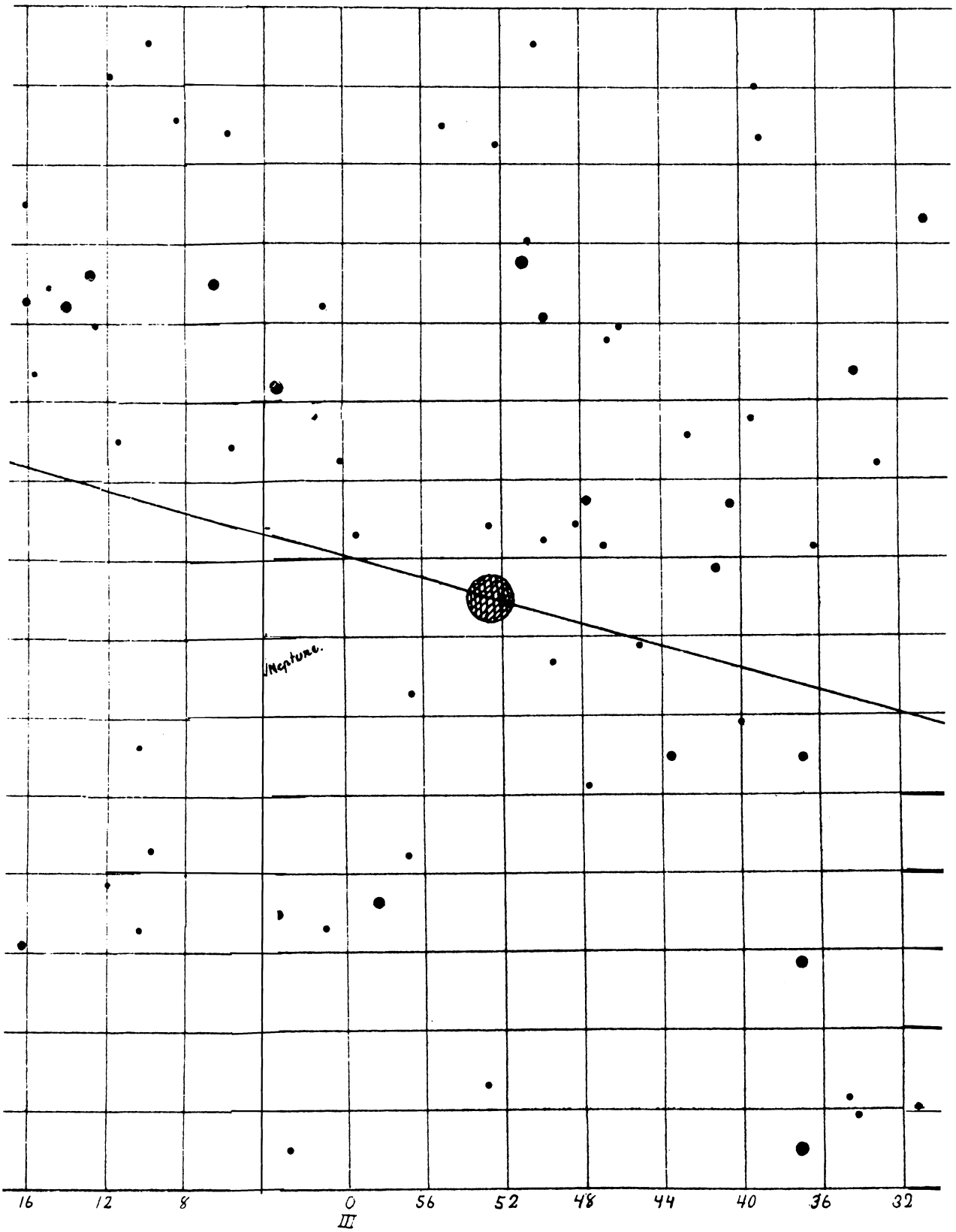


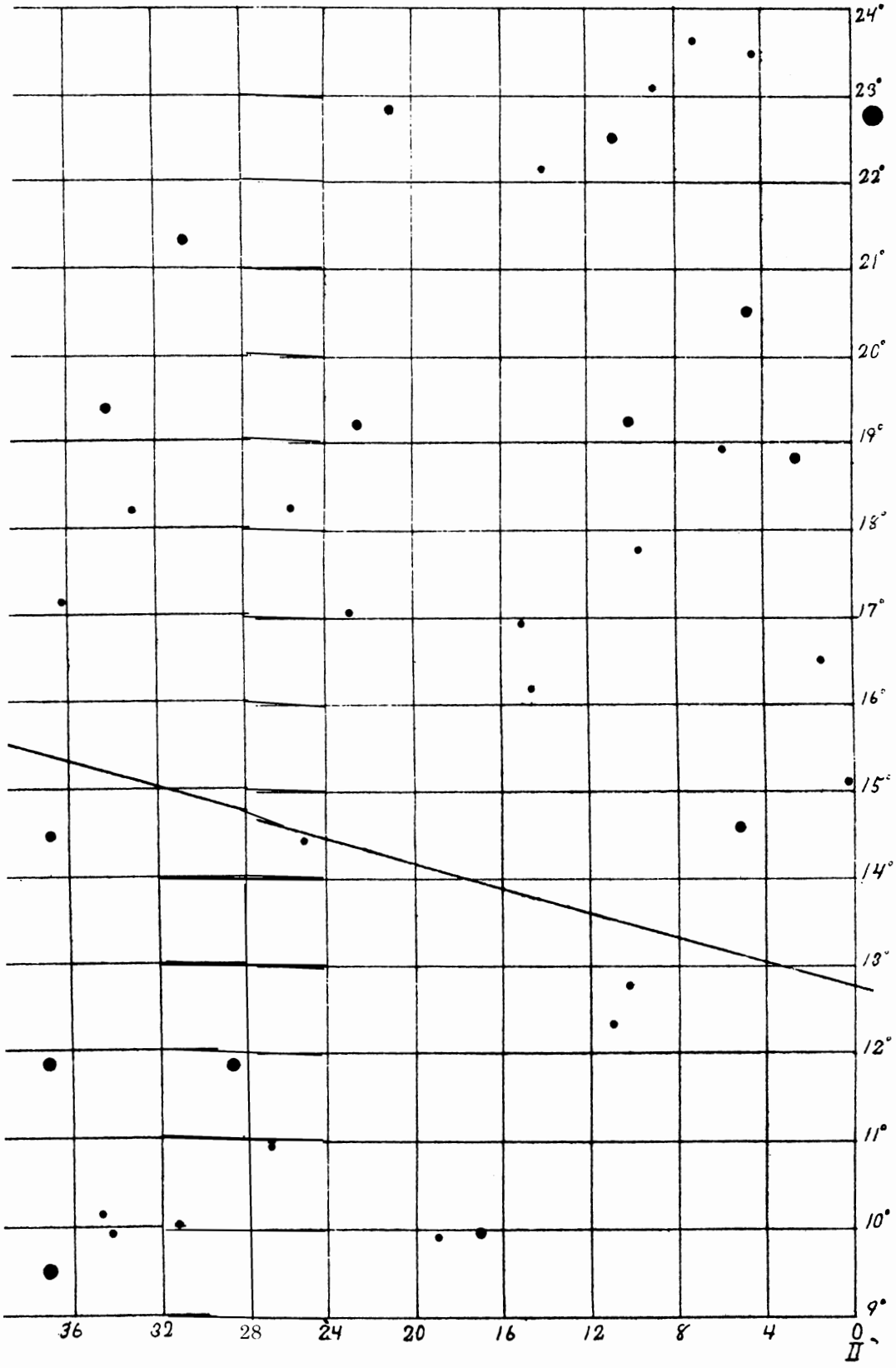
Photo-Lithographed expressly for "SCIENCE," by The Forbes Co., Boston.

(to the 7th Mag. inclusive) near the Sun, May 6th, 1883, by Edward S. I



2 } STAR MAGNITUDES

y Edward S. Holden. (The places are for 1855.0)



as in a Latin version. By means of these photographic copies of the map, the legends in Spanish are made accessible. I am not aware that they have ever been published as a whole. There is something more than a suspicion that some of the legends in Latin contain statements not to be found in the Spanish. A committee of the Massachusetts historical society, to whom a copy of this map, presented by the president, has been referred, intend to publish an English translation of the legends, with the result of a comparison with the Latin version.

CHARLES DEANE.

MAP OF THE PLANETS AND STARS NEAR THE SUN, MAY 6, 1883.

THE map which is given in this number of SCIENCE has been prepared to aid astronomers, who may observe the total solar eclipse of this year, in a search for Vulcan. It does not need to be said that the eclipse of May 6 is the most favorable for this purpose that will occur for many years, and it is to be hoped that the unique opportunity will not be lost.

The present map has been compiled with care from the *Durchmusterung* catalogue, checked by comparison with the maps and by proof-reading. It contains all the stars of the *Durchmusterung* within the region near the sun, down to the seventh magnitude inclusive, together with a few stars of a slightly lower magnitude, which are only added when their omission would spoil a configuration. The planets Saturn and Neptune are also added. The positions of the map are amply accurate for the purpose intended.

EDWARD S. HOLDEN.

Washburn observatory, university of Wisconsin, Madison, Jan. 11, 1883.

FIRST USE OF WIRE IN DEEP-SEA SOUNDING.

IN view of the great impetus recently given to deep-sea sounding and dredging (especially in the United-States navy and coast survey work) by the application of steel piano-wire in place of line, it is interesting to learn the fate of the first experiments in that direction. These have been extracted by Commander J. R. Bartlett, U.S.N., of the hydrographic office, from the log-book of the United-States schooner Taney, Lieut. J. Walsh, U.S.N., commanding, October, 1849, to June, 1850.

The Taney took on board at the Brooklyn navy-yard, Oct. 22, 1849, a large iron reel containing 7,000 fathoms iron wire graduated Nos. 7 to 13; an extra reel with 5,900 fathoms wire, size not stated; and a small reel with 300 fathoms iron wire, size No. 5.

The Taney sailed Oct. 26, 1849, to take deep-sea soundings in the North Atlantic. On the 15th of November preparations were made for sounding with wire in lat. 31° 59′ N., long. 58° 43′.5 W., not far from Bermuda. After reeling out 5,700 fathoms, the wire parted near the surface, owing to the fact that the splices had some projecting ends which caught upon each other. The No. 7 wire parted. It is noted in the log, that the circumstances were favorable and the sounding plumb. It seems, however, that the lead used was altogether too small, about twelve pounds only; and this was the reason why so much wire ran out without its being recognized that bottom had been reached. The weight of the wire of course carried it out, and would have continued to do so as long as any wire was left. The lead was armed with a Stellwagen cup, but the detaching apparatus and dynamometer for sounding were then unknown.

The same experience was repeated on the 9th of May, 1850, when 2,200 fathoms of wire were lost; and on the 18th, when 2,050 fathoms were lost, with the thermometer, twelve-pound lead, and Stellwagen cup. On the 22d of May the last attempt was made with the same results; the wire parting in every instance owing to one splice catching upon another on or near the reel. The last time only an eight-pound lead was used, with 1,900 fathoms of wire out when it parted. The party returned to New York, June 3, 1850, shortly after which Lieut. Walsh died. This ended the trial of wire for the time; to be revived when the invention of steam reeling-apparatus, detaching sounding-cups, the dynamometer, and 'accumulators' had rendered its use practicable. It seems singular, however, that the difficulty as to the splices was not remedied on the spot, and that heavy leads were not tried.

WILLIAM H. DALL.

AN EXTENSION OF THE THEOREM OF THE VIRIAL AND ITS APPLICATION TO THE KINETIC THEORY OF THE CONSTITUTION OF GASES.[1]

CLAUSIUS has designated as the theorem of the virial the equation which he first arrived at in a paper upon a *New mechanical theorem applicable to heat.*[2] This theorem applies to stationary progressive motion, such as the molecules of gases are assumed to have in the kinetic theory of gases, and, when so applied, may be written in the form

$$akt = \tfrac{2}{3} pv + \tfrac{1}{3} \Sigma rR \quad . \quad . \quad . \quad . \quad (1)$$

[1] Abstract of a paper read by H. T. EDDY, Ph.D., University of Cincinnati, before the Ohio mechanics' institute, Jan. 18, 1883.

[2] Phil. mag. [4], vol. 40, p. 122.

in which p, v, and t denote the specific pressure, volume, and absolute temperature of the gas; k is the specific heat at constant volume; a expresses what fraction of total kinetic energy, kt, is progressive; r is the mean distance of the molecules; and R the mean intermolecular attraction; the summation being taken for all possible pairs of molecules.

This investigation depends upon d'Alembert's equation expressing the relation of the force acting to the linear acceleration of the mass moved.

The present paper proceeds to employ Euler's equation, expressing the relation of the couple acting to the angular acceleration of any material body, to find an analogous equation for the mean rotary motion of bodies in a state of stationary rotation. An equation is obtained precisely analogous to that found for progressive motion. But, since the intermolecular attractions cannot accelerate the rotary motion, they do not appear in the equation, which can finally be written in the form

$$a'kt = \tfrac{2}{3}pv \quad . \quad . \quad . \quad . \quad . \quad . \quad (2)$$

in which a' expresses what fraction the mean rotary energy is of the total kinetic energy. Two cases, however, must be excepted from the general equation (2). The first of these is that of molecules which are smooth figures of revolution, such as diatomic molecules may be supposed to be; and the second is that of smooth spheres, such as monatomic molecules may be. In these two cases it is shown that

$$a'kt = pv, \text{ and } a'kt = 0,$$

respectively.

It is further shown, that, in case a variation of state occur, that the variation of the last term in (1) must be always negative, or zero, when the temperature is augmented, as appears from comparisons of the formula with Thomson and Joule's experiments on the free expansion of gases in passing a porous plug, with Andrews's experiments on carbonic-acid gas above the critical temperature, with Berthelot's principle of maximum heat, and with mechanical systems in motion under the control either of gravitation or of elastic forces.

An investigation is then made of the ratio of the specific heat at constant pressure to that at constant volume in imperfect gases; the result of which, for molecules of more than two atoms, may be expressed in an equation of the form

$$k = \tfrac{4}{3} - \tfrac{1}{3}b + \tfrac{1}{6}(5 + i)c \quad . \quad . \quad . \quad . \quad (3)$$

in which k is the ratio of the specific heats in question; b expresses what fraction of the total kinetic energy exists in the form of atomic vibration within the molecule; c, which is very small, expresses what fraction the work done against intermolecular attractions is of the same quantity; and i is the exponent expressing what inverse power of the distance between the molecules may be taken as the approximate law of intermolecular attraction. i is always taken as greater than unity, and usually greater than 3; while the value proposed by Maxwell is 5. The experimental values of k lie between 1.33 and 1.25. If the value of c be assumed to be zero, as it is in perfect gases, then a lies between zero and $\frac{1}{4}$; and, if c is not zero, a must exceed $\frac{1}{4}$ for some of the more complex gases; i.e., the energy of vibration of the atoms within the molecules may exceed one-fourth of the mean kinetic energy of the gas.

In the case, however, in which the molecules consist of but two atoms each, the equation obtained is

$$k = \tfrac{7}{5} - \tfrac{2}{5}b + \tfrac{1}{5}(4 + i)c \quad . \quad . \quad . \quad . \quad (4)$$

in which the value of b must be much smaller than when the number of atoms is larger. The experimental values lie between 1.41 and 1.39; and for air, for which k has been more accurately determined than for other gases, the accepted value is, according to Wüllner, 1.405; in which the influence of the term containing c is perceptible. The value, however, of k, derived from Regnault's most accurate determination of the velocity of sound, is 1.395. For molecules consisting of one atom each, the equation obtained is

$$k = \tfrac{5}{3} - \tfrac{2}{3}b + \tfrac{1}{3}(2 + i)c \quad . \quad . \quad . \quad . \quad (5,$$

The experimental value of k, as found for vapor of mercury (the only known monatomic gas), by Kundt and Warburg, is 1.67.

This ratio has been previously investigated by Boltzmann and by Watson, by the help of generalized co-ordinates expressing the number of degrees of freedom of the system; but it has not been found possible to assume any integral number of degrees of freedom which would cause the value found for k to agree with experimental results. The opinion is expressed by the author, that this method is unsuited to the investigation of this question, because any elastic connection or attractive forces neither allow perfect freedom, nor impose absolute restraints, such as are contemplated by the method.

So far as known, this investigation explains, for the first time, what Watson, on p. 39 of his treatise, regards as "the great difficulty in the establishment of the kinetic theory of gases on the molecular hypothesis."

CONSEQUENCES OF SPLEEN EXTIRPATION.

IN a preliminary notice (*Centralbl. med. wissensch.*, 1882, 900) Winogradow describes the results of spleen extirpation, as manifested in the blood, lymphatic glands, and bone-marrow of dogs, several of which were kept alive in good health for more than two years after the splenotomy.

After the operation the number of red corpuscles in a cubic millimetre of blood always falls in a short time, occasionally within a few days. This diminution is most marked from a hundred and fifty to two hundred days after the splenotomy, when in some cases the red corpuscles are less than half their normal number. Later they become again more abundant. In the first twelve months the size of the red corpuscles is not altered: after that there is found a gradually increasing proportion of abnormally small specimens; and the red corpuscles of exceptionally large size, of which some are always found in normal dog's blood, entirely disappear. The white blood corpuscles show no morphological change; their absolute number is sometimes increased, sometimes diminished.

In one case, a hundred and thirty-two days after the splenotomy, there was found marked enlargement of most of the lymphatic glands. They were much softer than normal, and red on section, especially in the cortical layer, looking much like splenic tissue. This coloration depended mainly on red blood corpuscles which were abundant in the lymph channels of the gland; and was in part due to deposits of brownish-red pigment, which Winogradow ascribes to the detritus of broken-down corpuscles.

The marrow in the central cavity of nearly all the long bones was red-colored, and presented the general appearance of the red marrow of the cancellated bony tissue of young dogs. This color was due to red corpuscles lying outside the blood-vessels in the spaces of the proper marrow tissues.

Later (five hundred and seventeen to seven hundred and sixty days after the spleen removal) similar but less marked divergences from the normal struc-

ture were found in both the lymphatic glands and the bone-marrow.

The blood of a dog which has undergone splenotomy, when transfused into the vessels of another dog, causes in the lymph-glands and bone-marrow phenomena similar to those above described. The author thinks they are in the main due to increased extravasation (? *diapedesis*) of red blood corpuscles.

H. NEWELL MARTIN.

THE CACHAR EARTHQUAKE OF 1869.

THE Geological survey of India publishes in vol. xix., part i., of its memoirs (1882), an account and discussion of the Cachar earthquake of north-eastern India, Jan. 10, 1869. The observations were made and the study begun by the late Dr. Thomas Oldham, then superintendent of the Survey: the work is lately completed by his son, R. D. Oldham, now a member of the geological corps The memoir gives a general account of the shock and its destructive effects; notices of previous descriptions by Oldham, sen., Godwin-Austen, H. F. Blanford, and Archdeacon Pratt, which in the present view seem largely erroneous in their theoretical parts; and a discussion of the position, depth, and shape of the seismic area, and the velocity of the earth-wave's motion and translation. It is well illustrated by photographs, lithographs, diagrams, and maps.

Cachar (or Silchar), where the shock produced great destruction, and after which it was named, is a town on the Barak river, at the southern base of the rainy Jaintia hills, about 300 miles north-east of Calcutta. The seismic vertical was some 80 miles farther north, as determined by thirty-six intersections falling within an area forty miles by four or five; or, excluding the less satisfactory lines, on an area twenty miles by three or four. The depth of the focus is estimated from several tolerably accurate observations at two stations, at thirty miles — or somewhere between twenty-five and thirty-five miles — below the surface. The area over which the shock was felt was an oval measuring 650 miles north-east and south-west, and 400 miles across, covering 250,000 square miles, and including Patna and Hazaribagh on the west; the Ganges delta and Chittagong on the south; the head waters of the Namtonai (branch of Irrawaddy) on the east; and the southern slope of the Himalaya on the north. In the latter direction, the extension of the shock was not determined. Within this, a smaller oval or isoseismal line is drawn to show the region of great destruction; this is symmetrically placed around the seismic centre. The velocity of wave-translations, estimated over a difference of seismic radii of 180 miles,[1] was 1.2 miles a second, which is regarded as very high and improbable, although the observations on which it is based — chronometer time noted by Major Godwin-Austen in the hills forty miles north-east of Cachar, and the clocks stopped by the shock in the surveyor-general's office in Calcutta — seem trustworthy. The wave-motion, even at a distance of eighty-five miles from the seismic vertical, was thirty feet a second; decidedly greater than that found by Mallet for the Neapolitan earthquake of 1857. The large value of the angle of emergence at Cachar is ingeniously accounted for as a result of upward refraction of the wave in passing through the loose alluvial sands. In spite of the violence of the shock, few lives were lost, and few buildings overthrown: the reason being that most of the houses are of wood and bamboo, elastic enough to escape great injury; or, if of masonry or brickwork, the walls are heavy and low, supporting each other against overthrow. A church-tower, a saw-mill, and a two-storied palace were thrown down. A secondary action of the shock produced greater destruction at certain points. The alluvial deposits along the river-bottoms sometimes contain strata of soft, water-logged quicksand; and where the heavy clays overlying these are cut through by the streams, they are often cracked parallel to the steep bank by the earth-wave, and then settle down, and slide on the soft sands beneath. If this happen in a village, the buildings are torn to pieces by the differential motion of their foundations, even if able to escape the effect of the shock. Connected with this effect is the formation of 'sand-craters,' which are shown to result from the wet quicksand being forced up through a vent or crevice opened in the overlying clays; the open cup-like form being produced by the back-flow of the water after the shock passes on. These are finely illustrated, and at once recall the figures given in Lyell's 'Principles' of the 'circular hollows' formed on the Calabrian plains by the earthquake of 1783.

The memoir closes with an appendix giving simple instructions for earthquake observations, and we cordially join the author in the hope that such observations may soon be undertaken at the meteorological stations throughout the earthquake districts of India.

W. M. DAVIS.

[1] There seems to be an error of 100 miles in the distance of Calcutta from the seismic vertical given on p. 84. Correcting this, there would be a difference of 280 miles between the two seismic radii in question, and the velocity of wave-translation would rise to about two miles a second, — even more excessive than is given in the text.

LETTERS TO THE EDITOR.

[*Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*]

A class-room experiment.

The class experiment commonly employed for demonstrating chemical decomposition consists in heating mercuric oxide, and showing that oxygen is given off while mercury remains behind. An easier and equally beautiful experiment may be performed with crystallized copper formate. This salt, when heated over a gas-flame in a dry test-tube, readily decomposes; oxides of carbon are evolved, and a brilliant residue of metallic copper is left. The formate is easily prepared by boiling copper oxide with formic acid, and filtering. On cooling, fine blue crystals are deposited. Although this experiment involves no new facts, I believe its applicability to class-room purposes has been generally overlooked.

F. W. CLARKE.

Domestic ducks that fly abroad like pigeons.

Facts relating to the history of the domestication of animals are so rare that it is highly important to keep them in view when once they are presented. In this category may be placed O'Donovan's account of the domestic ducks of the Caspian Turcomans. He noticed, especially in the villages bordering upon the south-eastern coast of the Caspian Sea and the Atterex delta, that great flocks of ducks are reared by the inhabitants.

"But so nomadic are the habits of these birds, and so strong are they upon the wing, that it is all but impossible to distinguish them from their wilder brethren that people these solitudes in such vast numbers. I have frequently been astonished at seeing what I took to be a crowd of fifty or sixty mallards come flying into the midst of the village, and, forming in some open space, proceed to march in serried files into the hut devoted

to them; and I have called down the wrath of the inhabitants upon my head by discharging my gun at them. They fly away for miles along the coast, keeping themselves carefully separated from the wilder sea-birds, and invariably return to their domicile at a certain hour in the evening." — (*The Merv oasis*, i. 159.)

Can any of your readers state to what species of duck reference is here made? and are any similar facts regarding domesticated or semi-domesticated ducks on record? F. H. STORER.

POOLE'S NEW INDEX.

An index to periodical literature. By William Frederick Poole, LL D. 3d edition, brought down to January, 1882, with the assistance, as associate editor, of William I. Fletcher, and the co-operation of the American library association and the Library association of the United Kingdom. Boston: J. R. Osgood & Co., 1882. 1442 p. Large 8vo.

THE appearance of a new edition of Poole's Index to periodical literature is not only an event of literary importance, but a matter of some moment to science as well. In recent times, literature and science have grown so close together that the student of one cannot well ignore the other; and a glance at the work before us will show how impossible it is to draw between them any sharp dividing-line. Of course it was not the purpose of the editor to index the periodicals of a purely technical kind; but popular science seems to have been included in his plan. Accordingly we find such journals as Silliman's, Nature, the American naturalist, the Popular science monthly, the Anthropological review, the Journal of the Franklin institute, the Mathematical monthly, Van Nostrand's engineering magazine, the Edinburgh philosophical journal, etc., exhaustively treated. Others of equal importance are omitted; but enough are included to make the volume one of real value to every worker in science, whether he be mathematician, astronomer, physicist, chemist, naturalist, geologist, or engineer. The sins of omission count for nothing when balanced against the solid merits of the enterprise. The arrangement of the work is entirely by topics; and its extensiveness may be illustrated by the fact, that between the titles 'electric animals' and 'electrotype,' there are over two hundred and fifty distinct headings, and a large number of sub-entries besides. Many of the titles represent work by the most eminent electricians of the century.

To the student of science the volume, apart from its references to scientific journals, has two points of special interest. First, it contains what is wholly wanting in catalogues of scientific memoirs; namely, abundant material concerning the personality of scientific men. If one wishes to study the life and influence of Faraday, Humboldt, Agassiz, or Henry, here he will find references to a multitude of papers; such as biographical notices, obituaries, criticisms, sketches, and so on. In nearly every magazine, whether monthly or quarterly, matter of this kind is to be found; and Poole's Index gives us a systematic key to the entire mass of it. The saving of time to the student can hardly be estimated, and the value of the material thus rendered available is by no means small. Whatever great work a master in science may have done, we can better appreciate it if we know something of himself and his environment. Whenever, in studying a mooted question, we try to assign weight to differing authorities, it is worth while to get at some knowledge as to the personal equation of the men. This is particularly true with regard to the bitterer controversies.

The second point of interest above referred to is the evidence which the Index offers as to the extraordinary influence which science exerts, even upon journals which are ostensibly quite outside of its own domain. Every one of the leading magazines is subject to this influence. We find symptoms of it in the scientific references scattered through literary, philosophical, and political essays, and in the host of papers in which science is sought to be popularized. Even poetry, which some critics assert is independent of and above science, is getting to be full of scientific allusions. Many of the popular essays upon scientific themes have solid and permanent value, and yet they are not recorded in such catalogues as that of the Royal society. Only in this volume can we get readily on the track of them; and here we find the names of Herschel, Tyndall, Huxley, Faraday, Helmholtz, Agassiz, and many others, to whom science seemed a matter of human interest, rather than a secret chamber to be entered only by the initiated. Some of the papers here cited contain the first germs of great ideas; others represent the earnest efforts of discoverers to bring their work before the wider public; still others are pleasant summaries of recent scientific advance arranged by appreciative teachers. Whatever a truly competent investigator has to say is likely to be worth hearing; and even his colleagues may gain a clearer conception of his thought by listening to his attempts at popular simplification. Mr. Poole and his associates deserve the hearty thanks of all workers in science for the service he has done their cause.

SIR CHARLES LYELL.

Life, letters, and journals of Sir Charles Lyell, Bart., Author of Principles of geology, etc. Edited by his sister-in-law, Mrs. Lyell. In two volumes, with portraits. London, *Murray*, 1881. 457, 489 pp. 8vo.

I.

ALTHOUGH it has been more than a year since these volumes appeared, they have remained without any critical presentation to the American public. Science, like the rest of our modern life, goes so fast that there is scarce time for us to remember the dead of a decade ago. Thus it has seemed perhaps hardly worth while for our American journals to notice these admirable volumes. But it is not well for Americans lightly to pass by an admirable life of one who not only laid the solid foundations of the science in whose paths they have done so much good work, but who gave to their land and their people a patient study and a sympathetic understanding in days when other foreigners denied them both. Those who know the field of American travels will all agree that this country never had a juster or more loving critic than Charles Lyell. His two series of travels in this country, descriptive of his first and second visits to the United States, remain the best picture of American life in those years of imperfect promise, the fifth and sixth decades of this century. He made third and fourth voyages to this country, and on each of his journeys travelled extensively in the region east of the Mississippi. His papers on the geology of this country are among the most valuable contributions made by any European to the understanding of American geology; while the frequent references to American geology in his 'Principles' have served to make other parts classic localities in the science. These acts should be enough to warrant us in giving a careful study to his life, even if his peculiar place in the history of his science did not make him the most notable among all the great laborers in its fields.

It is, however, when we consider the place of Charles Lyell in the combination of sciences we call geology, that we find his true interest for all those who care for the progress of learning. No one conversant with the development of geology during this century, which includes its growth from the very germs of the science, can hesitate to give him the very first place among its many strong leaders, — a place that is unique in the history of the several sciences. The peculiarity of his position consisted in the fact that he was, during the forty years in which the science was taking its shape, an admirable critic of its work, — one who, from the circumstances of his position, his large social power, his penetration, sympathy, and capacity for individual research, was able to enforce moderation and judgment on all the workers on two continents.

When Lyell began to write the first of the eleven editions of his 'Principles' in 1828, geology was still contending with those prejudices which had retarded its progress, barriers which he, with the acumen of Bacon in dealing with the 'idols,' managed so well to overcome. In the immeasurable past which the recent researches of geologists had revealed, all sorts of speculations had been carried: vast deluges, periods of intense volcanic activity, epochs of sudden destruction and re-creation of animal life, were given room there. The aim of naturalists seemed to be to create a world as unlike that of to-day as it was possible to have it. The critical humor of Hutton or of William Smith had given place to a rage for speculation. On the other hand, the church, especially in England, had set its face against all theories that promised to weaken the dogmas of seven days' creation or the Noachian deluge. Lyell was the only geologist of his day who could have saved the science from the dangers of vagariousness that promised it a long period of trouble. Circumstances had favored his early training for the peculiar work he was to accomplish. His father was a Scotch gentleman of fortune, who had a strong taste for natural history, and made something of a name as a botanist. In his early youth Charles Lyell became deeply interested in collecting insects, — a taste which he seems to have kept during his life. As this collecting was done with discretion and study, it developed in him a power of close discrimination that was the foundation of much of his good work: no other study is so well fitted as is entomology to develop this capacity for details which is the condition of all good work in science.

After the usual rough training in humanity and the humanities in the preparatory schools, — a training that fortunately awaits every well-born British youth, — he went to Oxford, at the age of seventeen, and matriculated at Exeter College. There he laid the foundations of that excellent knowledge of the classics for which during his whole life he was distinguished above all of his scientific brethren. At every step in his future work we see the admirable results of this broad culture, this sense of perspective in the intellectual history of mankind, which is perhaps more necessary for the well-developed man of science

than for the student in any other field. It is this sense of the oneness of human history, this sympathy and understanding of men of all times, that gives the charm to his immortal Principles of geology; and in this day, when we are debating as to the use of classical training, it is well to ask what this book would have been if the Oxford element had not been there. It would perhaps have an equally valuable body of fact, but the informing spirit would have been wanting.

His power to make avail of his Oxford life was doubtless due to his keenness of appreciation of all forms of intellectual stimulus, though he took a fair rank in his college, winning second honors in classics. We see in his letters home that he has a lively interest in music, which had been an early-developed taste; for in his schoolboy days he had been the leader of a schoolboy orchestra. He is also something of a versifier; and some of his verses show a delicate fancy, though by no means a strong wing.

His first acquaintance with geology seems to have been made through Bakewell's Geology, which he found in his father's library; and that author's account of the earth's antiquity appears to have first aroused his curiosity to know more of the subject. While he was at Oxford, Buckland was at the height of his singular popularity. His lectures affirmed this early-acquired taste. His first geological journey was to Yarmouth, where he saw the great cutting power of the sea on that soft-cliffed coast. In the same year a journey to Staffa, of which his journal is given, served to possess him of the love for field-work. In 1818, when he was just of age, he made a tour through France, Switzerland, and Italy as far as Rome. His journal showed the keenest appreciation of the ordinary nature of travel, but as yet but little interpreting power. He appears, as were all others of his time, strangely blind to the structure of the Alps: even the parallel moraines on the glaciers puzzle him, — a matter that is one of the most transparent things in their history. The motion of the glaciers is not seen to be a problem: yet his critical spirit is awake; for, one of his party finding in an album the lines, —

> "Mont Blanc is the monarch of mountains:
> They crowned him long ago,
> Enthroned in ice, with robes of clouds,
> And diadem of snow," —

he well says, "It contains more real poetry than I thought could be found in all the albums of Europe." He did not recognize that they, a little garbled, were from Byron's Manfred, which had been published the year before. It may be that it shows us the place of birth of these the finest lines in that strange dramatic poem. Despite the veil that hid the deeper secrets of the Alps from his eyes, his good fortune showed him many things which served to lead his mind to the notion that the present forces of the earth are strong enough to explain the past. He saw the Goldau *éboulement*, or landslide, then but a dozen years old; and in the Rhone valley he beheld the frightful marks of the flood which poured from the lake formed by the Glacier de Bagne but six weeks before his coming.

WEEKLY SUMMARY OF THE PROGRESS OF SCIENCE.

GEODESY.

Length of a nautical mile. — In common parlance, the length of a nautical mile is considered as a 'minute of latitude,' without any consideration of the range of value included within this definition. A paper upon this subject by Prof. J. E. Hilgard, superintendent of the Coast and geodetic survey, has just been published. It gives the values of one minute under nine different definitions. The values are based upon the elements of the Clarke spheroid. One minute of latitude at the poles = 1,861.655 metres = 6,107.85 feet; one minute of latitude at the equator = 1,842.787 metres = 6,045.95 feet; one minute on the equator (considering it as a circle) = 1,855.345 metres = 6,087.15 feet.

As adopted by the Coast and geodetic survey and by the Hydrographic office, a nautical mile is *one-sixtieth part of the length of a degree on the great circle of a sphere whose surface is equal to the surface of the earth.* Using the Clarke spheroid, this definition gives a nautical mile = 1,853.248 metres = 6,080.27 feet. This value closely corresponds with the English admiralty knot of 6,080 feet. — (*Rep. U.S. coast surv.*, 1881, app. 12.) H. W. B. [172

Night signals for geodetic work (by Mr. O. S. Wilson of the N.Y. state survey). — Owing to the small number of days during any season when the air is in good condition for sighting points more than twenty-five miles distant, and the few hours during even good-seeing days available for such geodetic work, especially in measuring horizontal angles, it is important not only to use to the best advantage what daylight is available, but also if possible to lengthen every good-seeing day. Hence any device for continuing work during clear nights is of great value. For this purpose electric lights were used on the triangulation carried across the Mediterranean in 1879 by the French and Spanish governments, with remarkably good results; the error of closure of a triangle being but a trifle over one second of arc. Some of these lines were the longest ever sighted for geodetic purposes, one of them being 167.7 miles. The burning

of magnesium-wire, fed by clock-work, in the focus of a parabolic reflector, gives an excellent light; but this, like the electric light, is too expensive for ordinary geodetic uses. The U.S. coast and geodetic survey has used kerosene student-lamps in place of the magnesium wire in connection with parabolic reflectors, on lines of twenty-five miles, with satisfactory results. At a station in Virginia, occupied by C. O. Boutelle, angles measured by day were duplicated at night, and the mean error of the night-work was only two-thirds of that done in the daytime.

In 1881 Mr. Wilson procured a small locomotive head-light with a twelve-inch reflector, and two cast semaphore lenses, one twelve and the other fourteen inches in diameter. Each of these lenses was mounted in the end of a box in which a kerosene-lamp with a 'mammoth-leader' burner was placed at the focus of the lens. These three lights, being set near each other, were readily seen through a small telescope at a distance of thirty-five miles, and little if any difference of brilliancy was detected. The magnesium apparatus and the locomotive head-light each cost about thirty-five dollars; but the magnesium wire being expensive, and this light requiring constant attention, the cost of maintaining it is several times greater than that of operating the locomotive head-light. The cost of a semaphore lens mounted in a galvanized-iron box is from ten to fifteen dollars, according to the size. The expense of maintaining it is small, — not more than fifty cents a night, kerosene being cheap, and no attention being required after the lamp has been properly trimmed, and lighted a short time. These lamps have been seen by the naked eye at a distance of forty miles.

In order to diminish as little as possible the light in the field of the telescope, a series of mirrors was so arranged upon and within the tube as to illuminate the wires, and leave the field dark. It is believed that this has not before been done with small telescopes, the one used in this instance having an aperture of only two and a half inches. Kerosene hand-lamps, protected for use in the wind, were devised and successfully used for reading the circle and illuminating the wires. The night observations thus made at state survey stations in 1882 were apparently fully equal to those taken in the daytime by means of heliotrope signals; and about half of the primary observations were actually made in the time thus saved.

For readily finding a distant signal light at night, a reference lantern was placed a short distance from the observing-station. By this, rough settings were made for the signal-light needed, which could then be brought into view by a slight vertical movement of the telescope. — (*Alb. inst.; meeting* Jan. 30.) [173

MATHEMATICS.

Conjugate quadrangles. — M. Stephanos, in seeking to generalize a kinematical proposition announced by M. Tchekychef in his memoir *Sur les plus simples systèmes articulés qui fournissent un mouvement rectiligne approximatif au quatrième et au cinquième ordre* (St. Petersburgh, 1881), has arrived at a number of properties of conjugate quadrangles. M. Stephanos defines conjugate quadrangles as being formed by two systems of four points (A_1, A_2, A_3, A_4), (B_1, B_2, B_3, B_4), when, being placed upon a plane in any manner, without altering their respective dimensions, the corresponding points (A_i and B_i) form four pairs of conjugate points with respect to a circle. There is an infinite number of quadrangles B, conjugate to a given quadrangle A; and all of the B-quadrangles are similar one to another. If A and B are two conjugate quadrangles, the areas of the triangles A_2, A_3, A_4, etc., are proportional to the areas of the triangles B_2, B_3, B_4, etc. The respective ratios are denoted by $\lambda_1 : \lambda_2 : \lambda_3 : \lambda_4$ with $\Sigma \lambda_i = 0$. λ_1, λ_2, and λ_3 are given in terms of the cotangents of the angles of the triangles A_2, A_3, A_4, and B_2, B_3, B_4. Considering two conjugate quadrangles A and B situated in the same plane, and denoting by ρ_1, ρ_2, ρ_3, ρ_4, the distances between corresponding summits, it is shown, that, whatever be the relative positions of the two quadrangles in the same plane, we have always the relation:—

$$\lambda_1 \rho_1^2 + \lambda_2 \rho_2^2 + \lambda_3 \rho_3^2 + \lambda_4 \rho_4^2 = C;$$

where C is a constant depending only on the dimensions of the two quadrangles. — (*Comptes rendus*, Oct. 16, 1882.) T. C. [174

Conical umbilics. — The following is taken from a report by MM. Bouquet and Jordan upon a memoir presented by M. de Salvert to the Academy of sciences. M. de Salvert studies the sections of a surface $F(x, y, z) = 0$, in those singular points where the tangent cone is of the second degree by planes passing through the axis of the tangent cone. Each section consists of two branches crossing at the multiple point, and having for tangents in this point the two opposite generatrices of the cone: it is proposed to find the curvature of these two branches. The author finds a formula for this curvature, of which he shows the analogy to the known expression for the determination of the radii of curvature of a normal section at an ordinary point. An application is made to the case of the wave surface, and then the author seeks the necessary conditions that the assumed point shall be a conical umbilic: i.e., a point such, 1°, that the tangent cone shall be one of revolution; 2°, that the branches of the curve which correspond to its different generatrices shall all have the same curvature. The first of these conditions leads only to known results; the second introduces six new equations involving the third derivatives of F. — (*Comptes rendus*, Jan. 8, 1883.) T. C. [175

Subdeterminants of a symmetric system. — In July, 1882, Prof. Kronecker presented to the Berlin academy a memoir in which he established certain linear relations between the subdeterminants (minors) of a symmetric system. M. Runge deals with the same subject in the present paper, and claims to show that relations found by Kronecker are the only ones existing, inasmuch as all others can be expressed by linear combinations of Kronecker's relations. He also finds a method for the determination of a system of linearly independent subdeterminants in terms of which all the remaining subdeterminants of the same order are linearly expressible. — (*Journ. reine angew. math.*, xciii. 1882.) T. C. [176

Ternary quartics. — In continuation of his researches on the ternary quartic $x_1^3, x_2 + x_2^3 x_3 + x_3^3 x_1$, and on systems of conics, Prof. Gordan discusses the typical representation of the system formed by this quartic and a conic. He finds that the coefficients in this representation are entire functions of only twelve simultaneous invariants, five of which are expressible as rational functions of the other seven, which are themselves connected by an algebraic equation of the sixth degree; and all these relations are explicitly given. These relations reduce the number of independent invariants to six, which is evidently the actual number. The last part of the article is devoted to the solution of the converse problem of determining a conic when the invariants above mentioned are given. — (*Math. ann.*, xxiv. 1882.) F. F. [177

Equations of the seventh degree. — In this paper, Prof. Gordan applies the results obtained by him

in the paper noticed above to the solution of those equations of the seventh degree in which a certain function of the roots is unaltered by a group of 168 substitutions. Such equations arise in connection with the modular equations of elliptic functions, and had been previously studied by Hermite, Klein, and others. Klein had pointed out that their treatment should be made to depend upon the investigation of the system formed by a certain ternary quartic, which is transformed into itself by a group of 168 substitutions and an arbitrary conic. It was this which led Gordan to undertake his researches upon that system. In the present paper he forms certain seven-valued functions of the coefficients of the arbitrary conic; the sums of the powers of these functions are, in virtue of a general theorem previously proved, rationally expressible in terms of the fundamental invariants of the system; and the fundamental invariants are rationally expressible in terms of the sums of the powers. The seven quantities, then, being regarded as the roots of a given equation, the invariants in question become known, and the solution of the equation is reduced to the problem of finding the coefficients of the arbitrary conic when the invariants are given; the solution of which problem is contained in the preceding paper (No. 177). The whole investigation is extremely long and difficult; and Prof. Gordan announces his intention of recasting the method by which he obtained his results, and giving a presentation of them 'in which every trace of the way in which they were reached shall have disappeared.' — (*Math. ann.*, XX. 4, 1882.) F. F. [178

PHYSICS.

Acoustics.

Sounds produced by flow of liquids. — Tito Martini has continued the researches of Savart upon the sound produced by a stream flowing through a circular hole at the lower end of a long tube containing liquid. He finds that the pitch does not change gradually, but that a definite number of distinct notes are heard successively as the liquid column shortens by the outflow. The pitch depends on the length of the liquid column and on the velocity of efflux. The number of vibrations is proportional to the velocity of efflux, and the sound is pure only when the sound of the vein is one of the proper sounds of the liquid column.

A column of constant length gives notes in a harmonic series. When the sound is re-enforced by the column of air above, it becomes quite loud. If the walls of the tube are prevented from vibrating, the sound ceases. The relative velocity of sound in different liquids may be determined by finding the lengths of the columns of liquid which give the same note, and the results given in the paper agree very well with determinations by other methods. — (*Journal physique*, Nov., 1882.) C. R. C. [179

Vibrations of loaded bar. — MM. Sébert and Hugoniot have investigated by a new method the equations of motion of elastic bars, and especially the case of a bar carrying an additional mass at one end. — (*Comptes rendus*, Oct. 30, 1882.) C. R. C. [180

Determination of rate of tuning-forks. — Michelson has devised a new stroboscopic method, in which a fork — for example, an ut_2 (No. 1) — is compared with a second ut_2 (No. 2), kept in vibration by electro-magnets, and which last fork is compared directly with the seconds pendulum. The whole number of vibrations of fork No. 2 is supposed to be known. The fractions are found as follows: one prong of the fork carries a mirror; and a few feet in front of this is placed a Geissler tube, illuminated once a second, as the circuit of the induction coil in connection with it is broken by the pendulum. The image of the tube itself in the mirror is a broad band, against which the narrow flash is projected. The number of flashes between their recurrence in two similar positions on the broad image of the tube shows the number of vibrations per second to be added to or subtracted from the known whole number. Thus, if there are a flashes in one period, $128 \pm \frac{1}{a}$ is the true rate. As fork No. 2 vibrates continuously, great accuracy can be secured. A mercury globule was used in connection with the pendulum to complete the circuit; and, by means of a relay, a break was produced in the primary circuit of the induction coil. A very constant battery must be used with the electro-magnets of the fork. The method may be simplified by dispensing with the electric fork, and placing the fork to be rated vertically, and with one edge in the focus of a microscope with cross-hairs. The Geissler tube is placed horizontally behind the fork; and the positions of the edge of the fork with reference to the cross-hairs are noted. A table of measurements is given. — (*Amer. journ. sc.*, Jan., 1883.) C. R. C. [181

Experiments with resonance boxes. — At a recent meeting of the Berlin physical society, Prof. Christiani showed a mi_3 fork, which placed on its box gave a maximum of tone when one side rather than the other was turned to the mouth of the box. The action seemed to be due to the box rather than to the fork, though this had been rusted and retuned. It was also found that a singing flame tuned to mi_3 was silenced when a mi_3 resonating box was placed horizontally with its mouth at the top of the tube, while if the corresponding fork was placed on the box no such effect occurred. The same action was noticed with a resonator; the flame being silenced if this was in tune with the flame, but not otherwise. — (*Nature*, Jan. 4, 1883.) C. R. C. [182

Optics.

Density of luminiferous ether. — Note on Glau's determination of the density of the ether, by E. Wiedmann. If an error in this estimate be corrected, the result is measurably in agreement with that of Sir W. Thomson. — (*Wied. ann.*, 1882, 986.) C. S. H. [183

Whiteness of various sources of light. — The results of a series of observations with an instrument devised by Helmholtz, and by him named 'lenkoscope,' is given by A. König. The general principle upon which the instrument depends is the following: A white surface is illuminated by the light to be tested; and two adjacent images of this surface, polarized at right angles to each other, are observed through a Nicol's prism and a certain thickness of quartz cut perpendicular to the axis. With such an arrangement, the two surfaces would appear of complementary colors, the tints being determined by the azimuth of the Nicol, and the degree of saturation by the thinness of the quartz plate. With a thin plate the two portions of the field would always be very unlike; with a very thick plate, always nearly white and alike; and, finally, with a plate of intermediate thickness, the similarity would depend upon the azimuth of the Nicol. The value of the azimuth which yields the greatest similarity when a plate 20 mm. thick was employed — and this angle must evidently depend upon the color of the light used — was taken as an arbitrary measure of the whiteness of the light. The table characterizing various fa-

miliar sources of light is of interest. The angle β is the azimuth of the Nicol's prism.

SOURCE.	β
Petroleum flame	71.1°
Illuminating gas (argand = ordinary burner)	71.5
Lime light	76.7
Incandescent electric lamp (near maximum of brightness)	77.8
Arc light	about 79.0
Magnesium light	86.3
Sunlight	90.5

(*Wied. ann.*, 1882, 990.) C. S. H. [184

Diffraction in telescopes. — A paper on the effect of diffraction on the appearance of a bright disk of indefinitely great radius as seen in a telescope, by H. Struve. — (*Wied. ann.*, 1882, 1008.) C. S. H. [185

Polarization of diffracted light. — The investigation here described relates to the modification which plane polarized light undergoes in diffraction by a reflecting grating of glass, of collodion, or of speculum metal. It is thus closely allied to Fröhlich's research, though of a more general character. The author, W. König, found that within the range of deviation, where elliptical polarization was marked, the determinations of azimuth were not very satisfactory: hence attention was given chiefly to difference of phase in the two components. This difference was measured by a Babinet compensator. All of the results were in satisfactory accordance with Réthy's theory of spherical polarized wave-surfaces, by which he explained the phenomena observed by Fröhlich. The experiments go far to reconcile the contradictory results, obtained by experimenters, who, following Stokes, have attempted thus to determine the relation of the plane of polarization to that of vibration; but at the same time Réthy's theory seems to end all hope of deciding this interesting point by the most promising means hitherto suggested. — (*Wied. ann.*, 1882, 1016.) C. S. H. [186

Elliptic double refraction. — E. Lommel develops his theory of refraction, to apply to the case of propagation of light-waves in a medium which rotates the plane of polarization. The equations yield a form of Biot's law for rotation involving the index of refraction, which corresponds well with observation. — (*Carl's repert.*, xviii. 673.) C. S. H. [187

Galileo's telescope. — An extended discussion of the theory of this form of telescope, by W. Pscheidl. — (*Carl's repert.*, xviii. 686.) C. S. H. [188

(*Photography.*)

Photography as applied to animal locomotion. — A simple method of studying photographically the movements of animals is described by M. G. Demeny. In front of the camera is placed a rapidly revolving disk, containing a narrow sectorial window. A white animal is selected, which moves in the sun before a very black background, best an opening in a darkened shed. The exposures with sensitive plates may be reduced to the $\frac{1}{1000}$ part of a second, the intervening intervals being sufficiently long so that the images shall not be superposed. By knowing the rate of the disk, the speed of the animal may be measured from the negative. If the plate is caused to move in the opposite direction to the image of the animal, the exposures may be made more frequently without fear of superposition, as has been done by M. Marey in his 'photographic sun' (*La Nature*, April 22, 1882). By having a number of windows in the disk, the course of small, rapidly moving objects may be studied: for example, the trajectory of a white stone thrown from the hand, or a white paper attached to the circumference of a carriage-wheel. — (*Journ. de phys.*, Nov., 1882.) W. H. P. [189

Heat.

Production of low temperatures. — After comparing the various methods for producing low temperatures, Mr. Rawbotham concludes that the method by the evaporation of ammonia is the best; ammonia being preferable to other liquids, chiefly on account of its high latent heat, and high pressure at low temperatures. — (*Journ. Frankl. inst.*, lxxxv. 2.) C. B. P. [190

Heat of solution and of dilution of perchloric acid. — In his researches on the oxyacids of chlorine, M. Berthelot has been conducted to the study of the heat of formation of perchloric acid. The solution of the liquid monohydrated acid in one hundred times its weight of water at 19° sets free +20.3 cal. This enormous heat, which exceeds that of all the common monohydrated acids, explains the extreme difference which exists between the action of this acid in solution, and the action of the monohydrated acid. It is found that the molecular specific heats of solutions of perchloric acid, between 40° and 15°, can be represented by the formula, —

$$c = 18n - 2.3 + \frac{273.8}{n} - \frac{742.2}{n^2};$$

n being greater than 6.

The heats of dilution of the acid when in different degrees of solution can be represented by a peculiar hyperbolic curve, similar to that already found for nitric acid. — (*Ann. chim. phys.*, Oct., 1882.) C. B. P. [191

Specific heat. — A modified form of Regnault's apparatus has been employed by M. W. Longuinine for the determination of specific heats. By the revolution of the cylinder the body is dropped through the floor of the chamber, in which it is heated, through a space of 0.08m. into the calorimeter. In order to obtain accurate results, it is necessary for the substance to have a spherical form. When powders and similar substances are used, they are placed in a sphere of brass, the specific heat and weight of which are known. This apparatus appears to give more uniform results than Regnault's.—(*Ann. chim. phys.*, Nov., 1882.) C. B. P. [192

Change of chemical constitution by heat. — Herr E. Wiedman has shown that a number of salts containing water undergo chemical change when heated, though the temperature is below that of fusion. He has thus found two new modifications of the sulphates of zinc and magnesium. The result has interesting bearings in the determinations of tension, and of the heat of solution. — (*Wied. ann.*, No. 12.) C. B. P. [193

Electricity.

A determination of the ohm in absolute measure. — Notice was given by A. L. Kimball of the proposed redetermination of the ohm; the method to be used being the same as that used by Prof. Rowland in 1876, changes being made in the character and arrangement of the apparatus so as to avoid, so far as possible, the repetition of constant errors. A short account was given of the nature and importance of absolute measurement in general, in which the derived units are all based on the fundamental units of length, time, and mass, and derived directly from them. The nature of the unit of electrical resistance was then noticed, and attention called to the fact, that, in the electro-magnetic system of units, the unit of resistance bears to the units of length and time the relation of a velocity. Mention was made of the most noteworthy methods that have been used in determining the value of resistance in absolute measure, attention being called to the manner in which

the units of length and time entered into the experiments. — (*Johns Hopk. univ. sc. assoc.; meeting* Jan. 3.) [194

ENGINEERING.

Automatic inspection of railways. — The precise methods of modern physical research are fast invading the various fields of practical science, and enabling us to be more and more independent of guesswork every year. Nothing illustrates this more forcibly than Mr. P. H. Dudley's dynamometer car, which is drawn from one end to the other of any railway, and, as it goes, records automatically every imperfection existing in the track, and at the end of the trip presents a long roll of paper which is a complete telltale in regard to the exact state of the road. Every bad joint, every defective rail, every lack of correct alignment, either vertical or horizontal, is shown upon the diagram in such a manner as not only to indicate the precise location of the defect, but at the same time to suggest the remedy. The dynamometer car has been employed upon a great many of our more important railroads, with the most satisfactory results. — G. L. V. [195

Railway management as a science. — Art first, and science afterwards, has been the rule in all technological pursuits, to which railways are no exception. We are fast accumulating sufficient data to show that there is such a thing as a science of railway operation; and just as soon as this fact is recognized, this science will find a place in our technical schools. The *Archiv für eisenbahnwesen*, a periodical issued by the Prussian ministry of public works, announces that there will be in the winter semester of the universities of Berlin and Breslau, courses of lectures on railroad operation, including station and train service, signalling, organization and duties of employees, and railway mechanism; and also lectures on railway administration, including the arrangement of rates and fares, the discussion of wages, and railway statistics. A third course will be on railway law, and a fourth on railway transportation as a branch of political economy. — G. L. V. [196

CHEMISTRY.

(General, physical, and inorganic.)

Magnesium carbonate. — H. Beckurts has obtained the normal magnesium carbonate $Mg\,C\,O_3 . 3\,H_2O$ by heating a solution of the bicarbonate to 70°. From a boiling solution the precipitate thrown down had the same composition ($5\,Mg\,C\,O_3 . 2\,Mg\,(OH)_2, 7\,H_2O$) as magnesia alba prepared according to Pattinson's method. — (*Chem. tech. repert.*, xx. ii. 2, 149.) C. F. M. [197

Investigations on chlorine and bromine. — Determinations of the vapor density of chlorine and bromine when mixed with air, by C. Langer and V. Meyer, gave values corresponding to Cl_2 and Br_2. It is proposed to determine whether at high temperatures these substances, like iodine, will give a vapor density corresponding to the half molecule. — (*Berichte deutsch. chem. gesellsch.*, xv. 2769.) C. F. M. [198

Congelation of solvents. — In experiments upon the point of congelation of water, formic acid, acetic acid, benzol, nitro-benzol, and ethylen dibromide, M. Raoult tried the action of each solvent upon two hundred other substances. A solution of one grm. substance in 100 grms. of the solvent gave results from which the following law was deduced: A molecule of any substance whatever, when dissolved in 100 molecules of any liquid of a different nature, lowers the point of congelation of the liquid 0°.62, — a value nearly constant for different solvents. — (*Comptes rendus*, xcv. 1030.) C. F. M. [199

Formation of active oxygen. — Results obtained by Moritz Traube show that ozone is not produced by hydrogen in *statu nascendi*. The hypothesis of Hoppe-Seyler, that chemical processes which take place within the bodies of animals are identical with those resulting from putrefaction, and depend upon the presence of ozone produced by nascent hydrogen, must therefore be incorrect. In support of this hypothesis, Hoppe-Seyler asserted that nascent hydrogen from palladium-hydrogen would convert oxygen into its active condition. The author finds that hydrogen is not evolved from the alloy at ordinary temperatures, and that instead of ozone, in presence of water, hydrogen peroxide is formed. Other results seem to indicate that hydrogen peroxide is a product of reduction rather than of oxidation. — (*Berichte deutsch. chem. gesellsch.*, xv. 2421.) C. F. M. [200

Influence of pressure on the speed of chemical action. — Prof. R. B. Warder made the following remarks: "Menschutkin[1] has recently published his experiments on the decomposition of tertiary amyl-acetate by heating in sealed tubes. At 155° C., while the pressure was gradually increased by the formation of amylene, the speed of the reaction was found to increase until about half the ether was decomposed. Menschutkin's graphical representation of the progress of the reaction has a point of inflection at this stage. This fully accords with the theory of 'action of mass' if we assume that this reaction, like many others, is promoted by pressure.

If the speed of the reaction is directly proportional to the pressure, and if the increase in pressure is proportional to the amylene generated, the course of the reaction should be represented by the equation,

$$\log \frac{u_0}{m - u_0} - \log \frac{u}{m - u} = At.$$

Where u is the quantity of ether still present at any moment, to be eventually decomposed within the limit of the reaction, u_0 is the initial value of u; t is the time of action; $\frac{m - u_0}{m}$ is the ratio of initial to final pressure; and A is a constant, dependent upon the actual pressure, as well as the absolute coefficient of speed.

By making $m = 1.01u_0$, and $A = 0.04$, we obtain an equation which pretty closely agrees with Menschutkin's curve. — (*Ohio mech. inst.; sect. chem. phys.; meeting* Jan. 18.) [201

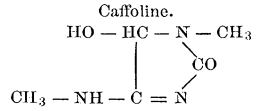
(Organic.)

Caffeine, theobromine, xanthine, and guanine. — In an extended investigation upon the constitution of these substances, Emil Fischer examined many of their derivatives and decomposition-products. Oxidation of caffeine with hydrochloric acid and potassium chlorate gave methylurea and amalic acid. This acid, without doubt, was formed directly from dimethylalloxan, in a manner analogous to the formation of alloxantine by heating alloxan with hydrochloric acid. By oxidation with nitric acid, amalic acid was converted into dimethylalloxantine, which formed cholestrophan by further oxidation. In the oxidation of theobromine, the resulting methylalloxan was immediately changed into the corresponding alloxantine, which gave methylparabanic acid by oxidation. Methylurea also was identified as a product of the oxidation of theobromine. As the decomposition-products of xanthine, alloxan was

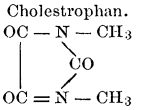
[1] Ber. chem. gesellsch. xv., 2512–2518.

recognized by conversion into alloxantine, and urea was found in the mother liquors. From bromcaffeine the amido-, ethoxy-, and hydroxy-derivatives were prepared; and from the bromine addition-product of hydroxycaffeine, diethoxyhydroxy- and dimethoxy-hydroxycaffeine. When treated with hydrochloric acid, diethoxyhydroxycaffeine was converted into apocaffein, which formed caffuric acid, $C_6H_9N_3O_7$, by boiling with water. By treatment with cold hydriodic acid, caffuric acid gave hydrocaffuric, from which, by decomposition with barium hydrate, methylhydantoin, methylurea, and carbonic dioxide were obtained. The formation of methyhyldantoin is regarded by the author of great importance in explaining the constitution of caffeine. This substance must contain beside the methylurea residue the carbon-nitrogen group of methylhydantoin. In the preparation of apocaffeine, the formation of another substance, hypocaffeine, was observed, which gave caffoline, $C_5H_9N_3O_2$ when warmed with basic acetate of lead. Caffoline gave methylurea by reduction and by oxidation with potassium ferrocyanide, potassium permanganate, and chromic acid, respectively methyloxamic acid, dimethyloxamid, and cholestrophan. The structure of caffoline, based upon the method of its formation and its decomposition-products, would be analogous to that of cholestrophan, —

Caffoline.

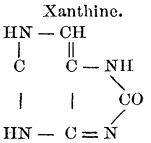


Cholestrophan.

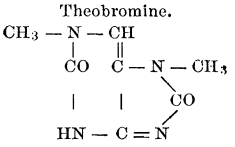


By heating xanthine-silver with methyl iodide, a methyl group was introduced with the formation of theobromine; which is, therefore, dimethylxanthine, caffeine being the trimethyl-derivative. The intimate relation existing between the plant bases caffeine and theobromine, and xanthine and guanine, which occur in animal excretions, would seem to indicate that these bodies are formed in organisms by the same chemical process. The following structure-formulae were proposed: —

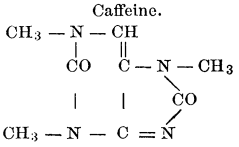
Xanthine.



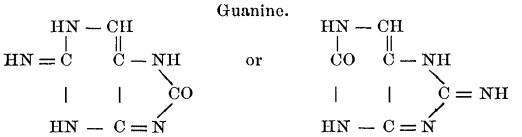
Theobromine.



Caffeine.



Guanine.



(*Ann. der. chem.*, 215, 253.) C. F. M. [202

Synthesis of uric acid. — By heating a mixture of one part glycocol with ten parts urea at 200–230°, Horbaczewski obtained a substance which proved to be identical in its composition and reactions with uric acid. — (*Berichte deutsch. chem. gesellsch.*, 15, 2678.) C. F. M. [203

Action of fomric acid on aromatic amines. — Results obtained by G. Tobias show that formic-acid derivatives of aniline, *o*- and *p*- toluidine, *α*- and *β*-naphtaline, can be obtained with greater ease than the corresponding acet-compounds. Sodium compounds of formortho- and formparatoluidine were examined. — (*Berichte deutsch. chem. gesellsch.*, 15, 2443.) C. F. M. [204

Second anhydride of mannite. — When mannite was submitted to dry distillation *in vacuo*, M. Fauconnier observed the formation of a sirupy body having the composition $C_6H_{10}O_7$. A study of its reactions showed that it contained no carbon atoms united by more than one bond; but whether the two remaining hydroxyl groups were primary, secondary, or tertiary, remained to be determined. — (*Comptes rendus*, 95, 991.) C. F. M. [205

Some derivatives of morphine. — That morphine contains at least one phenyl-hydroxyl group, was shown by M. Grimaux, who converted it into codeine by heating it with sodium ethylate and methyliodide. Codethyline (ethyl morphine) was formed when ethyl iodide took part in this reaction; and by the use of alkyl iodides, in general, a series of derivatives was suggested. Ethylen dimorphine was obtained with ethylen iodide. When sulphuric acid, in excess, was added to a solution of morphine in glacial acetic acid with a small quantity of methyal or methylenaceto-chlorhydrine, a purple color appeared in the solution, possibly due to the formation of the base $CH_2C_{17}H_{13}NO_3$ (methylen morphine). — (*Ann. chim. phys.*, 27, 273.) C. F. M. [206

METALLURGY.

Treatment of copper ores at Spenceville, Cal. — The ore, which is fine-grained pyrites in a sort of chlorite slate, is broken into small lumps to prepare it for roasting before being hoisted to the surface. It is then dumped on a few sticks around a loose brick flue, layers of brush are put on at intervals with the ore, salt is distributed through the pile, tank residue placed on the top to exclude the air, and the heap is then fired. The period of roasting lasts six months. There are fifty leach-vats, with a capacity of 120 tons of roasted ore; the leaching is hastened by boiling with steam, and the copper is precipitated by scrap-iron. Forty-two tons of 85% copper cement are shipped monthly; eight months' supply of ore is always kept on hand. There are now 12,000 tons roasting. — (*Min. and sc. press*, Nov. 18, 1882.) R. H. R. [207

Bull's process for iron-smelting. — This process consists in charging the iron-ore and flux, usually limestone, without any solid fuel, gas being used instead; highly heated air is also introduced in sufficient quantity to burn about ten per cent of the gas, and to give high enough heat to melt the charge. The gases rising through the ore are carbonic oxide and hydrogen, with the nitrogen from the air. The usual zone of gasification of the iron-blast furnace is wanting, leaving only the zone of reduction, carburization, and fusion. — (*Min. and sc. press*, Nov. 18, 1882.) R. H. R. [208

GEOLOGY.

Surface geology of the vicinity of Baltimore. — The principal features of the Baltimore area, according to P. R. Uhler, are expressed, first, in the hard rocks of the archaean age; second, in broad beds of softer Jurassic rocks; and, third, in the superficial drift materials. The first series includes the Laurentian system, the chloritic and serpentinic series, and the overlying mica schists and quartzites. These ancient terranes are exposed in plateaus, which

have been shaped by erosion, and have a height of from 300 to 500 feet. Although, in general, similar to the archaean of other regions, yet they are especially rich in hornblendic and pyroxenic rocks; while the highly feldspathic varieties are confined to a few localities, and are usually accessible only at low levels. Baltimore lies on the eastern margin of the broad archaean belt, extending from Canada to Georgia, and having the north-north-east trend of the Atlantic seaboard. It is unbroken westward to the triassic area, and is involved in a series of well-marked folds which attained their maximum development in the Jurassic period.

In the Baltimore area no formations intervene between the archaean and the Jurassic; and the last is represented only by its highest member, the Wealden. It reaches from Elkton, in Cecil Co., to beyond Washington, D. C., with an accessible breadth of about thirty miles. It rests directly upon the archaean, and is overlaid at various points by the cretaceous, tertiary, and post-tertiary; although in the vicinity of Baltimore it is covered only by the drift deposits. The thickness of the Wealden is not less than 500 feet, consisting chiefly of sandstone with beds of clay and gravel, all derived from the archaean, and containing vegetable fossils in abundance; although only one animal has been found, the Astrodon Johnstonii Leidy, a reptile supposed to be related to the iguanodon. — (*Johns Hopk. univ. circ.*, Feb., 1883.) W. O. C. [209

Lithology.

The hornblendic granite of Quincy, Mass. — Mr. Dodge's paper is valuable as showing in a convenient form the distribution of the granite and its adjacent rocks. The only other thing new in the paper is the assumption of two different granites in the area mapped, for which he advances no evidence, although other observers have in general regarded them as local modifications of each other. The paper is, moreover, by no means an adequate representation of what is known regarding the 'Relations of the Menevian argillites and associated rocks at Braintree and vicinity;' for the author does not show the relation of the known primordial argillite to any other rock (work that had been done before by others), but only the relations of some which he has assumed to be primordial. That these argillites are all of the same age, there is good reason to doubt; for in the Boston basin certain of these are found associated with conglomerates, unconformably overlying other argillites, and holding pebbles of the latter. These two different classes of argillites differ from one another in their lithological characters; and that difference, coupled with the association with conglomerates, occurs in Mr. Dodge's so-called Menevian argillites. — (*Amer. journ. sc.*, Jan., 1883.) M. E. W. [210

Meteorites.

The Lodran meteorite. — The microscopic and general characters of this meteorite which fell at Lodran, India, Oct. 1, 1868, were quite fully described by Tschermak in 1870 (*Sitzungsb. akad. wissensch. Wien*, 1870, lxi.). Dr. Stan. Meunier finds, on studying a section, that it appears to be composed of bronzite, olivine, pyrrhotite, chromite, and grains of metallic iron. If, however, a chip is heated and then suddenly plunged into mercury, the silicates fall to pieces, while the metallic portion is seen to form a very fine network or sponge-like mass. This network is the same as, but finer than, that formed by the iron in the celebrated Pallas meteorite, to which this is allied. Dr. Meunier regards the Lodran meteorite as a true sandstone, having a metallic cement. The metallic portion was evidently posterior to the accumulation of the silicate grains, which must, before their cementation, have formed a true meteoric sand. He does not regard water action necessary to produce such a sand, but thinks, rather, that it was produced by volcanic action. — (*Comptes rendus*, xcv. 1176.) M. E. W. [211

Two Japanese meteorites. — Dr. Edward Divers describes two meteoric stones supposed to have fallen in Japan about 150 years ago. They are covered largely with the thin black fused coating common in meteorites, but in the interior are light gray in color, earthy, porous, somewhat soft, and interspersed with particles of iron and pyrohotite (troilite). The chemical analysis is as follows: —

Sp. gr., 3.62

O.	33.18	Al.	1.00
Fe.	26.13	Na.	0.72
Si.	17.15	Mn.	0.57
Mg.	14.02	Cr.	0.28
S.	2.15	Sn. } C. }	0.15
Ni. } Co. }	1.99	P.	0.15
Ca.	1.39	K.	0.13
		Total	99.01

This is the common composition of the chondritic meteorites. — (*Trans. asiat. soc. Japan*, x. 199.) M. E. W. [212

The meteorite of Mocs. — Attention is called by Mr. E. Döll to the form and surface of this meteorite, thinking that it fell in a region that with other meteorites forms a remarkable zone of falls. — (*Verhandl. k.-k. geol. reichsanst.*, 1882, 159.) M. E. W. [213

MINERALOGY.

Mispickle. — As a result of simultaneous crystallographic and chemical investigations, A. Arzruni and C. Baerwald have shown that the prismatic angle of this mineral varies, and is accompanied by a corresponding variation in sulphur. For an increase of 0.00001 in the axis $\breve{a}$ there is an increase of 0.0236 % S, the length of the axis $\breve{a}$ in the varieties investigated varying from 0.67092 to 0.68964, and the sulphur content from 18.051 % to 22.472 %. Thus the mineral does not possess a constant composition, but varies in such a way as to have a definite effect upon the prismatic angle. — (*Zeitschr. kryst.*, vii. 337.) S. L. P. [214

Minerals from Juliane-haab, southern Greenland. — The following minerals have been described and analyzed by Joh. Lorenzen: —

Microcline feldspar.

Arfredsonite. This occurs in dark cleavable masses, hardness 5.5, G. 3.44, showing brilliant prismatic cleavage at an angle of 124° 22′; also grayish and of a more decomposed appearance. Chemical analysis of the dark cleavable variety showed that the iron was nearly all present as protoxide. The analysis agreed with the formula $11\,R\,Si\,O_3 + R_2\,O_3$, showing that the mineral holds a position among the amphiboles which contain a small quantity of sesquioxides.

Ainigmatite. A mineral resembling the above, with prismatic angle 114°, G. 3.80, is regarded as a distinct species, but no analysis is given.

Aegirine. This mineral occurs with arfredsonite, and is to be distinguished by the striations parallel to the prism; prismatic angle 86° 58′, hardness 5.5–6, and G. 3.63. Chemical analysis showed that the iron exists mostly as sesquioxide, and gave the formula $Na_4\,R''\,R^{iv}{}_4\,Si_8\,O_{25}$; or, —

$$\left.\begin{matrix} 2\,Na_2\,Si\,O_3 \\ R''\,Si\,O_3 \\ R^{iv}{}_4\,Si_5\,O_{16} \end{matrix}\right\}, \text{ where } \left\{\begin{matrix} Ca : Fe = 2 : 3. \\ Al_2 : Fe_2 = 1 : 11. \end{matrix}\right.$$

As will be seen, the mineral is a little too basic for a bi-silicate.

Sodalite. This mineral is always colored green, arising from inclusions of arfredsonite. The crystals are dodecahedral, usually about the size of a pea; hardness 5.5–6, G. 2.31. The mineral decomposed by acids, and filtered from the undecomposed inclusions, gave upon analysis the formula $\left\{\begin{matrix} 2\,Na\,Cl. \\ 3\,Na_2\,Al_2\,Si_2\,O_8. \end{matrix}\right.$

Nepheline. This occurs in hexagonal prisms, seldom larger than a hazel-nut, terminated by a pinacoid; also massive, accompanied by the foregoing minerals. G. of crystals, 2.60; massive, 2.63. The results of analysis gave the formula $R'_2\,Al_2\,Si_2\,O_8$; which, although once accepted, has now given place to the more complicated $R'_8\,Al_8\,Si_9\,O_{34}$.

Endialyte occurs crystallized and massive. The crystals show a great number of planes. Hardness 5.5, G. 2.85. The author has determined the oxides of the cerium metals, amounting together to 2.27 p. c. He also finds an unusually large quantity of $Na_2O = 15.90$ p. c., and 1.91 p. c. Cl. The formula deduced from the analysis varies from that of Rammelsberg, and the large percentages of Na_2O and Cl may be due to inclusions of sodalite.

Lievrite. This mineral as occurring in Greenland is described for the first time. It occurs both massive and crystalline, the crystals much striated, and terminations usually wanting. Lustre, metallic; color, black; hardness, 6; and G. 4.05. The results of analysis gave SiO_2 29.30, Fe_2O_3 20.30, FeO 33.50, MnO 1.97, CaO 13.71, H_2O 1.90 = 100.68, giving the formula, —

$$\left\{\begin{matrix} 2\,Fe''_2\,Si\,O_4 \\ Ca_2\,Si\,O_4 \\ Fe^{iv}_2\,Si\,O_5 \end{matrix}\right\} + H_2O;\ \text{or, } H\,Ca\,Fe''_2\,Fe^{iv}\,Si_2\,O_9.$$

Lepidolite. This occurs in white shining laminae, of hardness 2.5, G. 2.81. The analysis is peculiar in containing no fluorine, a very large quantity of alkalies, and only one-half the usual quantity of alumina. It does not agree closely with any definite formula.

Steenstrupine. Under this name a new mineral is described, of a brown color, hardness 4, G. 3.38. It occurs crystallized and massive. The crystals are much curved, and are referred to the hexagonal system. The composition is complicated, as will be seen from the following analysis: Ta_2O_5 0.97, SiO_2 27.95, ThO_2 7.09, Fe_2O_3 9.71, Al_2O_3 2.41, Ce_2O_3 10.66, $(La\,Di)_2O_3$ 17.04, MnO 4.20, CaO 3.09, Na_2O 7.98, H_2O 7.28 = 98.38. Disregarding the Ta_2O_5, these values agree quite closely with the following formula: $Na_2\,R''\,R^{iv}_2\,(Si\,Th)_4\,O_{13}$, $3\,H_2O$. The author, however, making use of the old form of the oxides (Th O, Ce O, etc.), could see no relation between the metals present, and does not attempt to deduce any formula, reserving that till more analyses are made. — (*Min. mag.*, v. 49.) S. L. P. [215

METEOROLOGY.

Popular weather prognostics. — A paper by R. Abercromby and W. Marriott has been read before the English meteorological society, which "explains over a hundred prognostics, by showing that they make their appearance in definite positions relative to the areas of high and low atmospheric pressure shown in synoptic charts. The method adopted not only explains many which have not hitherto been accounted for, but enables the failure, as well as the success, of any prognostic, to be traced by following the history of the weather of the day on a synoptic chart. The forms discussed are: cyclones, anticyclones, wedge-shaped and straight isobars. The weather in the last two is now described for the first time." The paper has not yet been published in full. — (*Nature*, Jan. 4, 1883.) W. U. [216

Observations at Geneva and Great St. Bernard. — The meteorological *résumé* for 1881 by M. Kammermann is an admirable model, worthy of imitation by those who publish similar observations. The diurnal variations in temperature and vapor tension are expressed analytically by Bessel's formula. The amplitude of barometric changes at Geneva exceeded that at St. Bernard by 1.14 mm., while the rainfall at the latter station was more than one-third greater than that at the former. It would be an improvement if the meteorological year adopted coincided with the civil year instead of beginning with December. — (*Arch. sc. phys. nat.*, Dec. 15, 1882.) W. U. [217

PHYSICAL GEOGRAPHY.

Depths of the sea. — Dr. Georg v. Boguslawski has prepared the following table of the greatest trustworthy depths found, up to 1882, in the several oceans and seas: —

	Latitude.	Longitude.	Metres.	Vessel.	Commander.	Date.
North Atlantic	19° 41′ N.	65° 7′ W.	**7086**	Challenger	Nares	1873
South Atlantic	19° 55′ S.	24° 50′ W.	6006	Essex	Schley	1878
North Sea	Near Neerstrand, Norway.		687	Pommerania	Hoffmann	1872
Baltic	N. W. of Gotland.		325	"	"	1871
Mediterranean	35° 5′ N.	18° 8′ E.	3968	—	—	—
Gulf of Mexico	25° 8′ N.	87° 18′ W.	3875	Blake	Sigsbee	1878
Caribbean Sea	20 miles S. of	Gr. Cayman.	6270	"	Bartlett	1880
North Pacific	44° 55′ N.	152° 26′ E.	**8513**	Tuscarora	Belknap	1874
South Pacific	11° 51′ S.	78° 45′ W.	6160	Alaska	"	1881
China Sea	17° 54′ N.	117° 14′ E.	3840	Challenger	F. Thomson	1875
Sea of Japan	11° 24′ N.	143° 16′ E.	**8367**	"	"	1875
Sulu Sea	8° 32′ N.	121° 55′ E.	4663	"	Nares	1874
Celebes Sea	5° 42′ N.	123° 34′ E.	4755	"	"	1874
Banda Sea	5° 24′ S.	130° 37′ E.	5120	"	"	1874
Coral Sea	16° 47′ S.	165° 20′ E.	4850	"	"	1874
Indian Ocean	16° 11′ S.	117° 32′ E.	5523	Gazelle	v. Schleinitz	1875
Southern Ocean	62° 26′ S.	95° 44′ E.	3612	Challenger	Nares	1874
	65° 42′ S.	79° 40′ E.	3060	"	"	1874
Arctic Ocean	78° 5′ N.	2° 30′ W.	4846	Sofia	v. Otter	1868

(*Verh. ges. erdk. Berlin*, 1882, 424.) W. M. D. [218

Playas and playa-lakes. — I. C. Russell, of the U. S. geological survey, describes the abandoned shore-lines and shallow wet-weather lakes of the Utah desert region. The deposits formed in the old lakes are of two kinds: first, those formed in broad, open basins, — soft, fine, greenish saline clays, tenacious when wet, and commonly saturated with alkaline water a few feet below the surface: second,

deposits of small basins without outlet, — fine, loose, light-yellow silt, white when dry. In both of these, the coarser beds wedge out away from their source. The old Playa beds, indicating a time of desiccation, may be covered with true lake-beds, showing a more moist climate. — (*Pop. sc. monthly*, Jan., 1883.) W. M. D. [219

GEOGRAPHY.

(*Arctic.*)

Nelson's explorations in the Yukon delta. — The long residence of Mr. E. W. Nelson at St. Michaels, Norton Sound, Alaska, and the large collections obtained there by him for the National museum, are matters generally known, not only to those immediately interested, but also to the general public. His report has been anticipated with much interest. Unfortunately a too enthusiastic application to study, on his return, acting on a constitution perhaps somewhat weakened by past hardships, produced symptoms which rendered a change of scene and climate imperative as a preventive of worse evils. Mr. Nelson is now recuperating in Colorado, and is still working on his report, which will appear among the professional papers of the signal-corps of the U. S. army, but will be somewhat delayed. During his service as signal-corps observer at St. Michaels, he took part in several long sledge expeditions over little-known parts of the Yukon delta, and was able to gather a large amount of information on the geography of an area in regard to which no authentic data are on record. This information is, of course, of an approximate nature only; but, such as it is, it forms an important and valuable addition to our knowledge. Most of Mr. Nelson's notes were placed in the hands of the authorities of the U. S. census, and form the larger proportion of the new information contained in the map of Alaska lately issued by that office. Pending the publication of his complete report, he has prepared a brief account of the most important of his expeditions made in December and January, 1878–79, which has just appeared in the proceedings of the Royal geographical society of London (November number), together with a map embodying his additions to the geography of the Yukon delta. The journey in question extended from St. Michaels along the coast to the trading-post of Andreievski, at the northernmost mouth of the Yukon, thence by the Kusilvak mountain, across the delta to the vicinity of Cape Rumiantzoff, then near the coast and parallel with it to Cape Vancouver, and around to the mouth of the Kuskokvim River, the western bank of which was traversed some fifty miles northward; then the party struck across the portage to the southern bend of the Yukon, which was descended to Andreievski, after which the original route was followed to St. Michaels. Among the more important features developed were the form of the coast about Cape Rumiantzoff; the number and approximate position of the streams and inlets entering the coast between that point and the mouth of the Kuskokvim; the insulation of Cape Vancouver, which forms part of a large island separated by the large, newly named Baird Inlet, and two broad but probably shallow channels from the mainland; and the approximate location of numerous inland lakes, streams, and villages of natives. Numerous ethnological details appear in the narrative. The island off Cape Vancouver has appropriately been named Nelson Island, and a bay north of it Hazen Bay, after the present enlightened head of the signal-corps, who has done so much to promote research and exploration in these northern regions. W. H. D. [220

(*North America.*)

March of the centre of our population. — This question is discussed by L. Simonin on the basis of our census-reports; of which he says, "Four or five years are given to discussing the data, formulating the results, and illustrating them with splendid maps, making a number of magnificent folio volumes, which are distributed very generously." After describing the exceptionally rapid growth of population, and the westward advance of its centre at the rate of fifty miles a decade from the Chesapeake in 1790 to Cincinnati in 1880, he asks, "When will the centre of population agree with the centre of surface, and what will the population be then?" The answer is: in 320 years, or in 2200 A.D., this change will be accomplished, with a total of 1,600,000,000 souls, — more than the present estimated population of the world. There is, of course, much chance of error in the calculation. It was objected, that Africa might some day turn away the tide of emigration from the United States; but M. Simonin thinks it will not be Africa's turn till America is filled, and that it will never offer the opportunities found here. It was further objected, that Chinese immigration might vitiate the calculations. M. Simonin answers, that this source of increase has been but small, and is now stopped by law. Emigration from the United States is not considered sufficiently probable to affect the result. — (*Bull. soc. géogr. Paris*, 1882, 557.) W. M. D. [221

(*Europe.*)

Finland. — Max Buch prefixes an historical account of the political condition of Finland, with a brief description of the country. On the north-west, where highest, two peaks rise to about 2,000 feet altitude; thence to the south-east the country descends, the heights generally wooded, and the valleys well cultivated. The numerous lakes are mostly narrow, and are dotted over with countless little wooded islands. Of these, Lake Saima serves as a type, extending from latitude 61° to 64°, and yet often no wider than an ordinary river. Besides these larger lakes, there are countless smaller ponds, often separated only by narrow necks of land. The streams are rapid, with numerous falls; those of the Imatra, the outlet of Lake Saima, being renowned. The shore-line is deeply indented, giving many harbors, which are further protected by a fringe of plentiful islands. The climate is relatively mild, the average temperature of Abo, on the southern coast, being 4.6° C., and that of the northern coast —2.6° C. In climate and vegetation Finland differs less from Italy than from southern Greenland, though in the latitude of the last-named country. The population is about 2,060,000, with 40,000 more women than men. — (*Ausland*, 1882, 910.) W. M. D. [222

Hungarian census. — Tables and charts prepared by Ignaz Hátsek from the census of 1880 show a total population, under the Hungarian crown, of 15,642,000, with 236,000 fewer males than females (1,000 to 1,031); a total area of 324,000 □ kilometres; and an average of 48 inhabitants to the □ kilometre, — an average increase of 1.4 per cent since 1870. One-half the population belong to the Roman-catholic church; next come the Greek oriental, the reformed, the Greek catholic, and the Augsburg evangelical. Hungarian is spoken by four-tenths of the population, Croato-Servian and Rumanian by one-seventh each, German and Slovak by one-eighth. — (*Peterm. mittheil.*, 1882, 447.) W. M. D. [223

(*Asia.*)

Russians and English in western Asia. — The reading of an account of Lessar's second journey in

the Turkoman country, before the Royal geographical society last November, was the occasion of an interesting discussion on the old question of the meeting of Russian and English forces in western Asia. Sir H. Rawlinson gave high praise to Lessar's work as novel and accurate. The 'great mountain chain' which the optimists contended would protect India turns out to be a "paltry line of sandstone hills, not 1,000 feet in height, which could be crossed by a carriage-road in a couple of hours, and which would crumble before the touch of a Russian railway-engineer." He thought the present desert into which the Tedjend and Murgab flow was formerly a lake, known to the ancients as the *Aria Palus*, from which there was water-way to the Caspian. An important aid in the disappearance of the lake was probably the diversion of a branch of the Oxus from it into the Aral. He admitted that recent Russian conquest had done much in stopping robbery and suppressing the slave-trade, but thought that Afghanistan was 'beyond the scope of her influence and action,' and hoped that Lessar's project of a railway from Askabad to Herat might not be realized. Sir Bartle Frere thought the sooner the English railway-engineers pressed forward from India to meet the Russians, the farther off would be the day when the military engineers would meet. Sir H. Norman and Sir R. Temple thought the meeting would not come in their time, and that construction of railways across Afghanistan by either outside power would be difficult, and would be prevented by international agreements. — (*Proc. roy. geogr. soc.*, 1883, 12.) W. M. D. [224

(*Africa.*)

Stanley and Brazza on the Kongo. — The dispute between these explorers concerning the possession of certain trading-posts on the Kongo illustrates the activity of modern African exploration, and its commercial inportance. Brazza made a treaty in 1880, with the people on the west bank of the Kongo about Stanley Pool; whose chief, Makoko, put himself under French protection, and ceded a strip of land on the west shore of the Pool for the establishment of a trading-post, named Brazzaville. The explorer concludes that a railroad must be built to this station, and, after very insufficient examination of the route, decides that it should leave the coast near Loango, and extend almost directly eastward up the Kuilu and its branch the Niari, and over a low mountain range to the Kongo, about two hundred and fifty miles.

The expedition from which Stanley returned last year was fitted out in 1879, chiefly by the liberality of the king of Belgium, with the object of opening a free way for trade up the Kongo to inner Africa. The most difficult part of the undertaking was the building of a road from Vivi, just below the first falls of the Kongo, 230 miles up the valley to Stanley Pool, above which the river is again navigable; and after many difficulties this was completed in 1881. During this work, near the end of 1880, Stanley met Brazza coming down the valley; but the latter said nothing about his treaty with Makoko. Six months later Stanley reached the Pool, and was at first well treated by the natives; but soon such startling reports about him were spread by Malamine, whom Brazza had left there to construct the trading-station, that he was forced to retire under the protection of a friendly chief on the southern shore of the Kongo. He descended the left bank to Mandjanga, where he collected his boxes and cases, and returned to the Pool. The station-house of Leopoldville was finished there in February, 1882; and then Stanley completed his trip by a long excursion up the Kongo in a small steamboat that he had brought up over his road, reaching a point 700 miles above the river-mouth.

Stanley condemns Brazza's action in claiming the country about the Pool for France; because he was sent out by the International African association, and had no right to acquire possessions for France alone. Brazza asserts that he was provided with a hundred thousand francs from the French government, and that he had no other support. (*Ausland*, 1882, 861, 894.) W. M. D. [225

Abyssinia. — In a short *résumé* of his trip from the Red Sea to Lake Tana (Tsana) and back, by the way of Adua, G. Rohlfs makes frequent mention of the small population now in this country, in spite of its being well enough watered, supporting a sufficient plant-growth, and not appearing unhealthy: it seems to result from the frequent wars that have latterly been fought with the Egyptians. Rohlfs criticises the map about Adua by Schimper, published in the Zeitschrift der gesellsch. f. erdkunde (Berlin), vol. iv., as absolutely valueless. The article is accompanied by a valuable map, prepared by Hassenstein, of the Abyssinian plateau, showing the routes of its various explorers. — (*Peterm. mitth.*, 1882, 401.) W. M. D. [226

(*Pacific Ocean.*)

Tahiti. — R. Beltrán y Rózpide begins a description of this group of islands, with an account of their discovery and synonymy, and a brief description of the several islands. Tahiti, the largest, has an area 1,042 sq. kil., with peaks rising to 2,236 met. (*Orohena*), 2,104 (*Pitohiti*), and 2,064 (*Aorai*). Although of volcanic rock, none of the summits have crater form. In a deep valley lies Lake Uaihiria, at an elevation of 431 met., without visible outlet: it is considered either a landslip or a crater lake. Around the shore of the island is a fertile and well-cultivated plain, for which the following data are the chief climatic factors, based mostly on observations by Harcouet at Papeite in 1878. The mean temperature is 26° C.; the daily variation is about three degrees, and the annual about twelve, ranging from an average of 19° and a minimum of 15° in June, July, and August, to an average of 31° or 32° from December to March. The sea-water has an almost constant temperature of 28° or 29°, the streams from the mountains vary from 20° to 23°, and in the elevated interior the thermometer sometimes falls to 8°. The barometric mean is 759.85 mm., with a maximum of 764 and a minimum of 756.9 mm. The winds are generally from the east, but sometimes come from south-east or south-west, and then bring rain. At night there is, as a rule, a cool breeze from the interior. Rain is heaviest on the south-east; but the measures were taken on the other side of the island, and showed 91 rainy days, and a fall of 1,200 mm. in the wet season from December to April, accompanied by low pressure, calms, and gusts, and 199 mm. of rain on 23 days of the dry season from April to December. The rains are much less frequent and heavy on the coast than in the interior, where they produce high floods in the steep valleys. Among the peculiarities of the island's fauna may be mentioned the climbing crab (Birgus latro), which climbs the cocoa-palms to cut off and drop the young fruit, then descends, and carries the nuts to the shore, where it breaks and eats them. Further details of the flora and fauna are given. The population of the group was estimated about 100,000 in the last century, but this was doubtless incorrect. More trustworthy counts about 1820 gave 10,000 to 15,000; in 1848, 9,967; in 1857, 7,200; in 1862, 10,147; and the last, in 1879, 10,978. — (*Bol. soc. geogr. Madrid*, xiii. 1882, 247, 387.) W. M. D. [227

BOTANY.

(*Structural and physiological.*)

A general method for examining vegetable tissues. — E. Fremy has contributed much to our knowledge of the cellulose group of organic substances. In a paper lately republished, he has brought together the more important reactions presented by the members of the group, and has followed this by a memoir in which M. Urbain has assisted. From both papers the following results are now summarized. The substances which form the skeleton of plants are principally pectose and its derivatives, cellulose and its isomers, vasculose, and cutose. *Pectose* acted on by alkaline carbonates is changed into pectates. These are decomposed by hydrochloric acid, which throws down gelatinous, insoluble pectic acid. *Cellulose* and its isomers agree in being readily soluble in concentrated sulphuric acid, but differ in the following points: cellulose dissolves at once in cuprammonia; paracellulose, only after the action of acids; metacellulose, not even then. *Vasculose* is not easily soluble in concentrated sulphuric acid, but, after the action of oxidizing agents, forms resinous acids separable by alkalies from associated cellulose. *Cutose*, the transparent membrane covering the aërial organs of plants, is dissolved neither by concentrated sulphuric acid nor by cuprammonia; but it dissolves rapidly without change in dilute alkaline liquids.

Following the facts above summarized, the authors give results of their analysis of different organs of plants, a few of which are herewith given: —

Root of Paulownia. — 1°. Substances soluble in water and in dilute alkalies: cork 45, soft bast 56, body of root 47. 2°. Vasculose: cork 44, soft bast 34, body of root 17. 3°. Paracellulose: cork 4, soft bast 4, body of root 30.

Stems. — Vasculose increases in amount with density of the wood. The pith contains of cellulose 37, paracellulose 38, vasculose 25 per cent. Cork contained: matters soluble in acids and alkalies 5, cutose 43, vasculose 29, cellulose and paracellulose 12 (cutose and vasculose forming together the *subérine* of Chevreul).

Leaves of ivy. — Water and substances soluble in neutral solvents 707.7, parenchyma (formed of cellulose and pectose) 240, fibres and vessels (formed of vasculose and paracellulose) 17.3, epidermis (cutose and paracellulose) 35.

Petals of Dahlia. — Water and soluble matters 961.30, parenchyma (of cellulose and pectose) 31.63, vasculose 1.20, paracellulose 2.27, cutose 3.60.

These interesting results throw considerable light on some obscure micro-chemical reactions, particularly the behavior of tissues with cuprammonia and with alkalies. With the authors' notes relative to the bearing of their results on technical chemistry, this notice cannot deal. — (*Ann. sc. nat., bot.*, 1882, 360.) G. L. G. [228

Fertilization of alpine flowers. — During a residence of several years at Grenoble, M. Musset has paid attention to the relative abundance of flowers and insects, finding all orders of insects well represented as high as 2,300 metres. Above this altitude Lepidoptera, Diptera, and certain Hymenoptera preponderate, as Dr. Müller and others have also observed. Flower-frequenting insects are found at all altitudes, in proportion to the abundance of entomophilous flowers; their visits being determined by several causes, the state of the atmosphere being one of the most important. It is stated that the waking hours of nyctitropic flowers and of insects are identical. — (*Comptes rendus*, Aug. 7.)

M. Heckel does not attach much importance to the visits of insects in the evolution of the large flowers characteristic of many alpine plants. He believes, in common with Bonnier and Flahault, that the more intense solar radiation is the chief factor in causing the larger size of flowers at high altitudes. — (*Ibid.*, Dec. 4.) W. T. [229

Pollination of Rutaceae. — In a paper read before the Linnean society of New South Wales, on plants found about Sydney, Mr. Haviland discusses the protandry of Philotheca australis and Boronia pinnata. The stamens are situated at first so as to bring the anthers over the immature stigma, as in other Rutaceae; this position insuring cross-fertilization with little waste of pollen. It is suggested, that, as they thus prevent the stigma from receiving the maximum of light and heat, their position may aid in retarding its development, and thus cause the protandry. — (*Nature*, Dec. 28.) W. T. [230

Value of crossing in plants. — For a number of years Prof. W. J. Beal of the Michigan agricultural college has been carrying on the work of experimentally testing the effects of cross and close fertilization so ably begun by Mr. Darwin. Most of his experiments have related to indian corn. As was to be expected, the results of no two years' experiments correspond at all closely; but they all show a marked gain when plants raised from seed grown some distance apart are inter-crossed instead of being allowed to self-fertilize. The average of four years' experiments shows the gain to be 27%. The least gain was a trifle under 10%; the greatest, 51%. One year's experiment with wax beans showed a gain of 136%. — (*Amer. journ. sc.*, Dec.) W. T. [231

Vegetable fly-trap. — Potonié finds that the feet of small flies that alight on the leaves of the West Indian Desmodium (Pteroloma) triquetrum are caught in the curves of the fine, arched leaf-hairs, so that their most desperate efforts to escape are unavailing. The insects captured belong to the genus Chloria. House-flies, with larger feet, are not captured; while ants and plant-lice have such small feet that they can walk over the leaves with impunity. The plant appears to derive no benefit from the death of its victims, which starve to death in captivity. — (*Kosmos*, Nov.) W. T. [232

(*Systematic.*)

New orchid in Florida. — The tropical Epidendrum cochleatum has been discovered by W. W. Calkins, growing upon the live-oak, at Jupiter Inlet, on the Atlantic coast of Florida. — (*Coult. bot. gaz.*, Dec., 1882.) S. W. [233

Western grasses. — A list, by F. L. Scribner, of the grasses recently collected by Pringle in Arizona and California, is accompanied by critical notes and descriptions of the rarer species. — (*Torr. bot. bull.*, Oct. and Dec., 1882.) S. W. [234

American conifers. — A popular account, by Dr. George Vasey, of the distribution and characteristics of the coniferae of the United States and Canada. — (*Amer. journ. for.*, Dec., 1882, and Jan., 1883.) S. W. [235

The tonga plant. — The drug tonga is shown by N. E. Brown to be the product mainly of a climbing aroid (Epipremum mirabile, Schott), widely distributed through the East-Indian Islands to Australia and Fiji. The plant has been hitherto involved in much confusion botanically; and a full description is given, with detailed synonymy. — (*Journ. bot.*, Dec., 1882.) S. W. [236

ZOÖLOGY.

Coelenterates.

Research on the lower invertebrates, during the years 1876–79. — The many American students who have no means of access to the journals of foreign learned societies, or to the periodical literature of zoölogy, will find, in Prof. Leuckart's summary of the work done upon the coelenterates during the years 1876–79, a very valuable abstract of the literature of this subject. Even the favored few who are able to consult the original works should be thankful to Prof. Leuckart for his brief but perfectly intelligible digests. — (*Arch. naturgesch.* xlv. ii. 591.) W. K. B. [237

Development of the tentacles of Hydra. — The great variability of fresh-water hydras demands that the order of development of the tentacles should be tabulated in a great number of specimens, in order to discover the law of their appearance. Jung has thus studied nearly two hundred and fifty specimens of three species; and he concludes, that, while there is no fixed order, each species does have a typical or average mode of development, which is more or less closely followed by the majority. The law varies with the species, and the results of Jung's researches are shown in the following diagrams: —

Hydra grisea.	Hydra oligactis.	Hydra viridis.
6	3	1
4 | 3	6 | 5	5 | 4
2 | 1	2 | 1	8 — 3 | 2 — 7
5	4	6
6	3	4
4 | 3	1 | 5	8 | 5
2 | 1	6 | 1	1 — 6 | 7 — 1
5	4	3

The vertical line is that axis of the bud which passes through the axis of the parent, and the upper end is the one nearest the body of the parent. The upper series of diagrams shows the typical order of appearance in normal buds of the three species named. This order was followed in 46% of 156 specimens of H. grisea, in 83% of 7 specimens of H. oligactis, and in 55% of 21 specimens of H. viridis. The second line shows the order of re-appearance in specimens after cutting off the oral end of the body with the tentacles. It was followed in 69% of 48 specimens of H. grisea, in 3 specimens of H. oligactis, and in 57% of 12 specimens of H. viridis. — (*Morph. jahrb.*, viii. 339.) W. K. B. [238

Mollusks.

Trade in Californian invertebrates. — Apart from the trade in oysters, clams, and other ordinary economic mollusks, there are certain specialities peculiar to the Pacific coast which do not appear in the trade-reports of other countries. Among these are 'abalones' (Haliotis californianus and H. splendens), the Californian pearl-oyster (Meleagrina californica), and several pearly univalves (Trochiscus Norrisii and Pachypoma gibberosum), small shells for ornamental purposes, and dried shrimps and shrimp-shells. The last are prepared by the Chinese, who catch them in large quantities, in nets of extremely fine mesh, by which very many small fish are also destroyed. The shrimps are dried on a mat over an open fire, and when thoroughly desiccated are threshed, the meats separated from the shells, and packed separately. The meats are used as food by the Chinese in all parts of the world. The shells are a particularly energetic fertilizer, superior to guano, and are packed in bundles of about 100 pounds weight for exportation to China. The various pearl-bearing shells are used for ornamental purposes, especially buttons. The export of abalones from San Francisco, by sea, in 1882, according to the annual 'market review,' was 4,638 sacks, valued at $23,455, against 4,522 sacks in 1881. They were exported to Germany (50 sacks), China (1,116 sacks), Hawaiian Islands (65 sacks), England (2,982 sacks), and New York (425 sacks), beside shipments eastward by rail. England received 563 barrels of pearl-oysters, and 49 barrels of other shells. The Chinese in South America received 99 packages of shrimp-meats, and those in the Hawaiian Islands 8 packages; while the enormous quantity of 9,611 packages of shrimps and shrimp-shells were sent to China. — W. H. D. [239

Crustaceans.

Paleozoic allies of Nebalia. — Having discussed its anatomy and development in a previous article, Prof. Packard compares Nebalia with the published figures of some of the paleozoic Ceratiocaridae, and concludes that the fossil forms should be separated from the Nebalidae as a distinct sub-order of Phyllocarida. Diagnostic characters are given for the order, and differential characters separating them from other crustacea. The memoir is to appear in full in Hayden's Twelfth report of the survey of the territories. — (*Amer. nat.*, Dec., 1882.) S. I. S. [240

New Devonian Crustacea. — J. M. Clarke describes and figures a new genus (Dipterocaris), and three new species of Ceratiocaridae from the Devonian, and remarks upon the characters of Spathiocaris and Lisgocaris, and on the wide range of S. Emersonii. — (*Amer. journ. sc.*, Feb., 1883.) [241

Shrimp and prawn fisheries. — In an article on the shrimp and prawn fisheries of the U. S., Richard Rathbun enumerates and remarks upon the edible species, makes suggestions in regard to the capture of some New-England species not now used for food, and then gives a general account of the fisheries of the Atlantic and Gulf, and the Pacific coasts. — (*Bull. U.S. fish comm.*, 1882, 139.) S. I. S. [242

Parasitic Copepoda. — R. R. Wright describes and figures in detail three species from fresh-water fishes of Canada. He seems to be unacquainted with the descriptions of allied North-American species by Kröyer, Smith, and Packard, with which his species should have been compared. — (*Proc. Canadian inst.*, n. s., i. Dec., 1882.) S. I. S. [243

Crustacean allied to Willemoesia. — C. Spence Bate describes a new genus and species (Eryoneicus caecus), taken in 1,675 fath., off the Canaries, by the 'Challenger.' It "approximates closely to Pentacheles, and adds another link between that and Eryon." — (*Ann. mag. nat. hist.*, Dec., 1882.) S. I. S. [244

Terrestrial Isopoda. — A. E. Eaton states, that Platyarthus Hoffmanseggii, which is found in ants' nests, and is reputed to be blind, is provided with eyes, and is as sensitive to light as other Oniscidae. — (*Ann. mag. nat. hist.*, Dec., 1882.) S. I. S. [245

Fauna of mountain lakes. — A. Wierzejski gives an account (in Polish) of the fauna of the lakes of the Tatra mountains, enumerating eighty species, of which forty-three are crustacea. Eight species of Cladocera and Copepoda are figured, but no new species are named. — (*Spraw. kom. fizyjogr. akad. umiej., Krakow*, xvi., 1882.)

The same author figures and describes the anatomy of Branchinecta paludosa, from the same region, and discusses its geographical distribution. — (*Rozpr. akad. umiej. wydz. matem-przyr., Krakow*, x., 1882.) S. I. S. [246

Insects.

Histology of insect wing-muscles. — The memoir of G. V. Ciaccio, to appear shortly in the Memorie dell' accademia di Bologna, may be thus summarized: In most insects the wing-muscles may be decomposed into fibrillae (in others, into striated fibres: Sphinx, Libellula, etc.). In the former case the fibrillae are united into bundles of various sizes by a cementing substance, in which the nuclei lie either both in the interior and upon the surface of the bundle (Hydrophilus, Dytiscus), or upon the surface only (flies). The bundles are held together by tracheae, and sometimes also by fat-cells. In the cement are further always found distinct particles (Aubert's *masse grumeleuse interfibrillaire*), which do not occur in the other muscles. The fibres are composed of fibrillae, and have nuclei either upon the surface (Cicada) or in the middle (Libellula). In some insects the fibrillae are arranged as in a folded lamella, the leaves of the folds running out from the centre of the fibre towards the surface, seen in cross-sections. The nerve-fibres terminate in motor plates (probably several for each fibre), consisting of a granular basal substance, in which are embedded the ramifications of the axis-cylinder. The wing-muscles are more readily dissociated into fibrillae than those of the rest of the body, from which they are further differentiated by the absence of a true sarcolemma. — (*Arch. ital. biol.*, ii. 131.) C. S. M. [247

Curious gall of a Trypeta. — Weyenbergh found in the Argentine Republic, on the terminal bud of a Heterothalamus, what resembled the froth which is secreted by the 'frog-spittle' insect, Cercopis spumaria L., but which, on touch, proved to be more substantial, or like a raspberry in texture, and on drying became tough like paper. Concealed by the froth was found a larva, which underwent its transformations within the same covert, and finally issued as a fly, which he names Trypeta (Icaria) Scudderi. The formation of the froth was observed in a larva placed on paper; it pressed its terminal segments together with nearly rhythmical movements, and so repeatedly squeezed little drops of clear fluid from the anus, which collected by and by into a frothy mass. — (*Verhandl. zool.-bot. gesellsch. Wien*, 1882, 363.) [248

(*Economic entomology.*)

Effect of pyrethrum upon Plusia brassicae. — Mr. Howard finds that the rate of pulsation of the heart of the larva is greatly increased at once, and falls but little before death. — (*Amer. nat.*, December, 1882.) J. H. C. [249

The cluster-fly. — A fly which has proved to be a great nuisance to housekeepers by entering dwellings in the fall of the year, and assembling in large numbers in beds, under table-covers, behind pictures, and elsewhere, is determined by Dr. Riley as Pollenia rudis Fabr. — (*Amer. nat.*, Jan., 1883; cf. *Psyche*, iii. 378.) J. H. C. [250

Wheat-stalk Isosoma. — Professor French observed, that in two wheat-fields which were in wheat last year ninety-three per cent of the stalks were infested by this insect; in one field which was in clover last year, not more than five per cent were infested. — (*Amer. nat.*, Jan., 1883.) J. H. C. [251

Promoting locust ravages. — It is estimated by Mr. J. P. Brown, that during the winter of 1874 one thousand car-loads of birds were destroyed and shipped to eastern markets from points west of St. Louis, Mo. — (*Psyche*, iii. 380.) J. H. C. [252

Buckeye leaf-stalk borer. — Mr. E. W. Claypole describes the habits of a new tortricid which Fernald names Steganoptycha claypoleana. — (*Psyche*, iii. 364.) J. H. C. [253

Habits of Thrips. — A species of Phloeothrips observed by Mr. Herbert Osborn in fruit-blossoms were doing much damage by injuring the styles, and thus preventing fertilization. — (*Psyche*, iii. 364.)

Although the species of Thrips are doubtless to a certain extent injurious to plants, Mr. Pergande believes that they feed chiefly upon nectar, and that they assist in fertilizing the plants they infest by carrying pollen. One species of Thrips preys upon the red spider. — (*Psyche*, iii. 381.) J. H. C. [254

VERTEBRATES.

The theory of the opening-twitch (Oeffnungszuckung). — An extended study of the opening-twitch leads Tigerstedt to the conclusion that the cause of it, and of the phenomena accompanying it in the nerve, lies in the polarization current, and, with some exceptions, in changes in the normal nerve current. The twitch due to a sudden decrease in the intensity of the polarizing current was not examined, so the above conclusion only applies to cases in which that current was completely broken. — (*Mitth. physiol. lab. Carol. inst. Stockh.*, ii. heft.) H. N. M. [255

Fish.

The development of the hypophysis in Petromyzon planeri. — Recent investigations by Prof. A. Dohrn have led to a different interpretation of the development of the hypophysis of Cyclostomes from that given by W. B. Scott or that of Balfour. The former stated in effect (*Morphol. jahrb.*, vii. 158) that the rudiment of the organ in question was unpaired. Its first appearance is marked by a slight depression above the mouth, which we may regard as the common invagination from which the nasal pit and hypophysis arise. Balfour states (*Comp. embryol.*, ii. 358), "I have observed a slight diverticulum of the stomodaeum, which I believe gives origin to it."

Dohrn holds, that his own more recent observations of the past summer show that the hypophysis arises as an independent invagination of the ectoderm between the nasal and oral invaginations. It has no connection with the latter, in that the upper lip is developed between the oral invagination and hypophysis. — (*Zoolog. anzeiger*, Nov. 6, 1882.) J. A. R. [256

Mammals.

Muscles of the raccoon's limbs. — Dr. H. Allen compares them with those of Felis domesticus. Triceps and some others undergo imperfect planal cleavage, showing imperfect differentiation; the number of nerves is variable, being most abundant in the less specialized muscles; the latter have more nerves in Felis than in Procyon; triceps and some others when normal in Procyon represent abnormalities in man; some are identical in both; others seem to be beyond the limits of variability in man. — (*Proc. acad. nat. sc. Philad.*, 1882, 115.) F. W. T. [257

Myology of Proteles. — M. Watson points out the characteristics of the muscles of Proteles cristatus, and agrees with Prof. Flower that the species should be placed in a separate family, allied to Hyaenidae and Viveridae but more closely to the former. — (*Proc. zoöl. soc. Lond.*, 1882, 579.) F. W. T. [258

Singing mice. — Herr Struck gives some notes upon a singing mouse which lived in captivity ten months. He inclines to doubt Cohen's opinion, that the musical tone is due to disease of the throat, and thinks that the mice may die in consequence of eating too rich food. — (*Arch. ver. freunde nat. Meckl.*, xxxv. 117.) — F. W. T. [259

INTELLIGENCE FROM AMERICAN SCIENTIFIC STATIONS.

GOVERNMENT ORGANIZATIONS.

Geological survey.

Rocky-mountain division. — This includes the territories of Montana, Dakota, Wyoming, New Mexico, and the state of Colorado, with headquarters at Denver. The corps consists of Messrs. S. F. Emmons, geologist in charge; Ernest Jacal and Whitman Cross, assistant geologists; and W. F. Hillebrand, chemist. This division forms part of the general subdivision of survey-work on mining-geology; i.e., its investigations are devoted more particularly to questions of direct economical importance.

The work already more or less completely accomplished by this division is as follows: —

1°. Monograph on the geology and mining industry of Leadville, which, owing to delays in the government printing-office, is not yet published, but of which an abstract appeared in the Annual report of the director for 1881. 2°. Bulletin on hypersthene andesite, now in press. 3°. Monograph on the geology and mining industry of Ten-mile district. 4°. Monograph on the basaltic mesas near Golden, Col., and their relations to the contiguous tertiary and cretaceous beds. The two latter are expected to be ready for the printer during the spring. 5°. Monograph on the geology and mining-industry of Silver Cliff. The topographic basis for this work is completed, and the geological work will be carried on during the coming summer. 6°. A study of the Denver coal-field. This work is designed to be carried on at intervals when the mountain regions are unapproachable on account of snow. The map, on a scale of one mile to the inch, covering an area of thirty square miles, was commenced in November.

As accessories a number of new and interesting minerals have been discovered in Pike's-Peak region.

Under the orders of the director, collections of typical crystalline rocks are being made, two hundred of each. The plan is, to obtain in time two hundred full suites of typical rocks which have been carefully studied both microscopically and chemically, and which will be distributed to various institutions of learning in the country to serve as a guide for students.

National museum.

Alaskan Fishes. — An important collection of forty-three species of marine fishes from south-eastern Alaska, including a new Triglops, has been recently received from Capt. H. E. Nichols. The collection is a noteworthy one, in that it furnishes proof that the range of the genus Sebastichthys extends far toward the north-west.

PUBLIC AND PRIVATE INSTITUTIONS.

Museum of comparative zoölogy, Cambridge, Mass.

The 'Blake' collections. — The publication of the preliminary reports has made excellent progress during the past year. There now remain unfinished of these, only those upon the fishes, halcyonoids, foraminifera, ostracoids, nemerteans, and some minor groups, as well as the report on the bottoms. It has been decided to publish only the final reports of the fishes of the east coast and of the holothurians. That on the fishes will be published in connection with the U. S. fish-commission, and include many species of shallower waters, first brought to light by the dredgings of the 'Fish-hawk.' Prof. G. B. Goode and Dr. Bean have already prepared the greater part of this report. Dr. H. Theel of Stockholm, who has undertaken to work up the holothurians, hopes next spring to transmit his final report to the Swedish academy of Stockholm, where it is to be published. Prof. Verrill has completed the examination of the east coast Halcyonariae and Actinariae, and is preparing a report of these and of those of the Caribbean Sea and Gulf of Mexico for the museum bulletin. Work is progressing favorably on the other reports. Mr. Agassiz has nearly completed the first part of the final report on the Echini: twenty plates are already on stone, and the remaining plates are well advanced. Mr. W. H. Dall is engaged in preparing the final report on the mollusks. His preliminary reports have already been issued. Mr. P. H. Carpenter has concluded his preliminary report on the Comatulae; and it was published in October, 1881. The crinoids, which had been placed in the hands of the late Sir Wyville Thomson for determination, to be worked up in connection with the 'Challenger' material, have been transferred by Mr. John Murray, of the 'Challenger' office, to Mr. Carpenter. Mr. Carpenter proposes in connection with his father, Dr. W. B. Carpenter, to work out as fully as practicable the minute anatomy of Pentacrinus, for which the material collected by the 'Blake' is quite extensive. In addition to the Pentacrinus material, the museum specimens of Holopus were also placed in his hands. Mr. Carpenter is now preparing a preliminary report on this part of the collection. During the spring, Prof. S. I. Smith completed the report on the Crustacea, collected off the Atlantic coast of the United States during the summer of 1880. The reports already published in the museum bulletin aggregate 465 pp., and 63 pl.; and the collections have also served as the basis of several papers published elsewhere.

Peabody museum of American archaeology, Cambridge, Mass.

Indian portraits. — The museum has received the originals of sixty-eight of the plates given in McKenny and Hall's folio volumes on the 'Indian tribes of North America,' published in 1836, together with thirty-seven other portraits of Indians. These portraits are of life-size, and with few exceptions were painted by Mr. C. B. King, an artist of considerable merit. They were presented to the museum by the heirs of the late E. P. Tileston and Amos Hollingsworth of Boston, and are unquestionably of great ethnological value.

NOTES AND NEWS.

— The editor of SCIENCE will be glad to receive and acknowledge subscriptions to the Balfour memorial fund, mentioned in the leading article of this week's issue: they may also be sent to Prof. H. Newell Martin, of the Johns Hopkins university, Baltimore, who is secretary and treasurer of the American committee.

— Prof. William L. Dudley of Cincinnati has recently succeeded in obtaining a good electro-deposit of iridium, which is susceptible of high polish. The bath is kept of constant strength, by continuous solution of the metal. Thin platinum foil, coated with iridium, retains its flexibility, while the coating does not readily scale. It has been proposed to use this process to give a hard face to copper-plate engravings.

As the iridium does not rust, its advantage over steel plates is obvious. The composition of the bath has not yet been announced.

— Lewis Boss of Dudley observatory, Miles Rock of the national observatory at Washington, and Charles S. Cudlip, photographer, who were sent by the U. S. transit of Venus commission to Santiago, Chili, have just returned home by way of Panama. They had a very clear day, and obtained good observations of all four contacts, and a complete set of photographs (204). Boss observed with a 5-in. Clark refractor, power 200; Rock, with a 3-in. Clark refractor, power 200; and the photographs were taken with a horizontal photoheliograph, of 40 feet focal length, forming an image on the photograph-plate about four and one-half inches in diameter. In the contact observations the images were almost steady, the definition sharp, and no atmospheric and other phenomena like black drop, etc., were observed, but simple geometrical contacts. The narrow ribbon of twilight around Venus was very silvery, and might be mistaken by inexperienced observers for direct sunlight. This twilight ribbon entirely surrounded Venus more than three minutes before second and after third contact.

— The annual meeting of the trustees of the Peabody museum of American archaeology and ethnology, at Cambridge, was held on the 17th inst., under the chairmanship of the Hon. R. C. Winthrop. The treasurer announced that he had received $900 from subscribers in aid of American research, in addition to the $2,550 mentioned in the last annual report; and the curator was authorized to expend the same for the continuation of explorations under his direction. The curator, in presenting his report, stated that he had also received $775 for special purposes, of which $550 were for Miss Fletcher's researches among the Indians. Twenty-five free lectures were given at the museum during the past year. Numerous gifts were made to the library, and the additions to the museum had been larger than in any preceding year; the large increase being chiefly due to the special explorations made either by the curator or under his immediate direction through the liberality of patrons of American research. The great importance of systematic explorations was insisted upon; and the curator showed, by his *résumé* of what the limited expenditure had permitted, what might be done were the museum provided with sufficient means for more extended work. He also called attention to the necessity of prompt action on the part of those who were willing to aid the museum in its work if thorough and systematic explorations were to be made in our country; as every year hundreds of mounds, earth-works, and ancient burial-places were destroyed. In concluding his report, he expressed the hope that some liberal patron of science would provide for an increase of the regular income of the museum; and also for an addition to the building, since the present accommodations would not permit of the exhibition of more than two-thirds of the collections.

— 'Parish botany' was the subject of a lecture which Dr. G. L. Goodale gave last Wednesday evening before the Divinity school at Cambridge, being one of a course addressed to students of theology by officers of other departments of Harvard university. 'The boundary-line between science and religion' was the topic discussed by Prof. John Trowbridge a fortnight ago.

— On the 8th of January was held the first meeting of the Colorado scientific society, an association organized for the promotion of scientific intercourse, observation, and record, in the State of Colorado. Its officers for the first year are S. F. Emmons, president; Richard Pearce, vice-president; Whitman Cross, secretary and treasurer; Richard Pearce, Hermann Beeger, A. Eilers, and W. F. Hillebrand, standing committee. The especial attention of the members will be devoted to geology, mineralogy, and chemistry, and their application to the industrial arts. The society certainly has in Colorado a most interesting field for investigation.

— At the meeting of the Biological society of Washington, Dec. 22, Prof. C. V. Riley pointed out the real nature of the so-called 'lignified snake of Brazil,' found beneath the bark of a tree: it is, in brief, probably nothing but the excrementitious filling of the burrow of a beetle larva, one of the Buprestidae. The head of the supposed serpent is a knot, which has been manipulated to increase the deception its natural form would give; and the tapering and tortuous form of the burrow would be impossible in a snake. Mr. Riley invites the owner to submit his specimen to a crucial test — dissection. Of course the owner declined: his idol would then have perished.

— Capt. Abney has lately delivered four very interesting lectures on recent advances in photography, before the London society of arts. The text is given in full in the last few numbers of the British journal of photography; but an excellent *résumé* may be found in the Popular science monthly for January, 1883.

— The first part of Vogt and Specht's Natural history of mammals has appeared (Munich: F. Bruckmann), with many well-executed drawings by the last-named author. The work is popular in tone.

— The British admiralty surveys in 1881, mostly in Asiatic waters, are summarized in the Nautical magazine (November, 1882, 819–828).

— A representative of the Newfoundland fisheries commission recently visited Washington for the purpose of studying the methods of propagating codfish employed by the U. S. fish-commission, with a view of putting them into practice in Newfoundland.

— A pharmaceutical journal in the German language has just been started in New York by Dr. F. Hoffmann, analyst to the State board of health. It is to be published monthly; and the January number, which has just reached us, contains original papers on Rhus cotinoïdes, by Prof. K. Mohr; on The position of pharmacy in regard to mysterious remedies in North America, by Prof. Dr. Maisch; a Report of the changes of the state of the pharmacopeia, by Dr. A. Tscheppe, besides two unsigned articles. Eight pages are given up to a monthly classified *rundschau* of pharmacy, excellently done.

— Dr. S. M. Burnett spoke at the meeting of the Washington philosophical society, Jan. 13, on Refraction in the principal meridian of a triaxial ellipsoid; regular astigmatism and cylindrical lenses; and was followed by Prof. William Harkness on the Monochromatic aberration of the human eye in aphakia. Jan. 27, Mr. H. H. Bates read a paper on the Nature of matter.

— At a meeting of the section of mechanics and engineering of the Ohio mechanics' institute, Jan. 23, papers were presented on Governors and fly-wheels, by Mr. James B. Stanwood; The wastage of water, by Mr. Thomas J. Bell; Saving of fuel, and smoke-prevention, by Mr. J. P. Kilbreth. A report on Pumping-engines for public water-supply was presented by John W. Hill, M.E.; and Prof. R. B. Warder made some remarks on The duty of steam-engines.

— At the Philosophical society of Washington, Feb. 10, Dr. A. F. A. King read a paper on the 'Prevention of malarial diseases, illustrating, *inter alia*, the conservative function of ague.' Mr. E. J. Farquhar and Dr. J. S. Billings took exception to the theories advanced. Capt. C. E. Dutton exhibited a series of oil-paintings illustrative of the volcanic phenomena of the Hawaiian islands.

— At the meeting of the American academy of arts and sciences, Feb. 14, the following papers were presented: Quantitative researches in photography, by Mr. W. H. Pickering; Photography as a means of determining the light and color of the stars, by Messrs. E. C. and W. H. Pickering; The historical hydrography of the west coast of North America, by Mr. J. Winsor.

— At the meeting of the Biological society of Washington, Feb. 16, Dr. Coues' paper on zoölogical nomenclature applied to histology was discussed, and papers were read on Biology and classification, by Mr. Newton P. Scudder; On the structures of protoplasm and karyokinesis, by Mr. John S. Ryder; The human fauna of the District of Columbia, by Prof. Otis T. Mason; Section cutting and mounting of hard woods, with illustrations, by Dr. Thomas Taylor.

— A lecture on the development of civilization was delivered in the U.S. national museum by Prof. E. A. Fay of the National deaf-mute institute, on Jan. 26, before the students of the latter institution. The gesture-language was delivered with remarkable ease and grace. The audience was very attentive throughout the lecture, and showed its appreciation of the points made by the speaker, by nods and movements of the fingers.

— We learn from the daily papers, that a proposition to abolish the geographical survey of New Jersey is meeting with favor on the part of some would-be economists in the legislature of that state. Apart entirely from its scientific worth, it would be hard to point out a state in the Union where the quiet inexpensive work of the state geologist has been so fruitful in economical value as here.

— A course of ten lectures on zoölogy is being given by Prof. A. S. Bickmore in the American museum of natural history, Central Park, New York, on Saturday mornings. The lectures commenced on Jan. 20, and are almost wholly upon the higher vertebrates, those in March being upon monkeys and the different races of men. We understand the course is very well attended; but the small lecture-room is a disgrace to such an institution if it contemplated such courses at the outset.

— In recognition of their scientific services at the international geological congress held last year at Bologna, the Italian government has created Prof. James Hall of Albany a Commander of the ancient order of Sts. Mauritius and Lazarus, and given Dr. T. Sterry Hunt of Montreal the rank and decoration of Officer of the same order.

— The first half of the second course of scientific lectures delivered in the National museum, under the auspices of the biological and anthropological societies of Washington, now completed, has met with the most remarkable and flattering success. The audiences increased in size from the first; the number of persons attending lectures far exceeding the seating-capacity of the hall, and in one instance exceeding two thousand. The first lecture by Capt. Clarence E. Dutton, on Rivers, although brief and not illustrated, contained a clear, and in many respects original, exposition of the *rôle* of rivers in the great drama of the globe. Prof. Otis T. Mason, who delivered the second lecture on the 20th ult., took for his topic The races of men, and gave a brief but succinct summary of the present condition of knowledge in this branch of anthropology. The lecture was illustrated by busts and casts of different races of men, from the museum collection, and by diagrams. Mr. George Kennan, who was third in the course, delivered an eloquent lecture on the Mountains and mountaineers of the Caucasus, and was listened to with closest attention during the two hours occupied in its delivery. Dr. D. W. Prentiss happily selected for his theme, Mesmerism in animals, — a topic which, although attracting much attention among French *savants*, is familiar to the

American public almost exclusively through the insufficient medium of the newspapers. Dr. Theo. Gill, who lectured on the 10th inst. on Mythical animals, departed from the consideration of animals which exist in fact, and gave his audience an account of some which exist in fancy. Dr. John S. Billings closed the first half of the course, taking for his theme, Germs and epidemics. He gave a concise account of the results of the latest investigations of Pasteur and others, regarding the relations of microscopic organisms to disease; weaving in, to a greater or less extent, his own views upon the matter.

The programme for the second half of the course is as follows: Feb. 24, Prof. L. F. Ward, the Plant life of the globe, past and present; March 3, Mr. W. H. Dall, Pearls and pearl-fisheries; March 10, Major J. W. Powell, Indian mythology; March 17, Prof. C. V. Riley, Adaptation and interdependence between plants and insects; March 24, Prof. C. A. White, the Teachings of paleontology; March 31, Dr. R. Fletcher, U. S. A., Human proportion in art and anthropometry.

RECENT BOOKS AND PAMPHLETS.

[*Continuations and brief papers extracted from serial literature without repagination are not included in this list. Exceptions are made for annual reports of American institutions, newly established periodicals, and memoirs of considerable extent.*]

Baltimore — Johns Hopkins university. Studies in historical and political science; ed. by Herbert B. Adams. Baltimore, *University*. 1882-83. 8°.

I. An introduction to American institutional history; by Edward A. Freeman. 1882. p. 39.
II. The Germanic origin of New England towns; by H. B. Adams. With notes on cooperation in university work. 1882. p. 57.
III. Local government in Illinois; by Albert Shaw: Local government in Pennsylvania; by E. R. L. Gould. Jan., 1883. p. 37.
IV. Saxon tithing-men in America; by H. B. Adams. Feb., 1883. p. 23.

Bible myths, and their parallels in other religions; being a comparison of the old and new testament myths and miracles with those of heathen nations of antiquity, considering also their origin and meaning. N. Y., *Bouton*. 1883. 650 p. 8°.

Bouchon-Brandely. Rapport au ministre de la marine sur la génération et la fécondation artificielle des huîtres portugaises. Paris, 1882. 51 p. 8°.

Brubaker, A. P. Physiology. Philad., *Blakiston*. 1883. 133 p. 12°.

Buet, Charles. Madagascar, la reine des îles africaines: histoire, moeurs, religion, flore, etc. Paris, *Palmé*. 1883. 12+391 p. 8°.

Cambridge entomological club. Annual reports for 1882. Cambridge, *Club*. 1883. 31 p. 32°.

Connecticut agricultural experiment station. Annual report for 1882. New Haven, *State*. 1883. 114 p. 8°.

Conn. — Shell fish commissioners. Second report. Middletown, *State*. 1883. 44 p., map. 8°.

Davy, Humphry. Les derniers jours d'un philosophe. Entretiens sur la nature, les sciences, les métamorphoses de la terre et du ciel, l'humanite, l'âme, et la vie eternelle. Ouvrage traduit de l'anglais, accompagné d'une préface et de notes, par C. Flammarion. *9e éd.* Paris, *Didier*. 1882. 32+374 p. 18°.

Fabre, J. Henri. Histoire naturelle. Géologie (programme officiel du 3 août 1880 et instructions ministérielles du 18 oct. 1881). *3e ann.* Paris, *Delagrave*. 1882. 260 p. 12°.

Ferris, B. G. A new theory of the origin of species. N. Y., *Fowler and Wells*. 1883. 278 p. 12°.

Gerhard, W. Paul. House drainage and sanitary plumbing. N. Y., *Van Nostrand*. 1882. 205 p. 24°.

Girardin, J. Leçons de chimie élémentaire appliquée aux arts industriels. *6e éd.* Tom. iii. Chimie organique. Paris, *Masson*. 1883. 620 p., 330 fig. 8°.

Grand, S. L'industrie huîtrière à Marennes; la Seudre et ses rivages; des claires à verdir, soins annuels à donner aux claires, etc. Paris, *Michelet*. 1883. 31 p. 8°.

Guérin, Victor. Rapports addressés à M. le ministre de l'instruction publique, sur sa mission scientifique dans le Liban. Paris, *imp. Levé*. 1883. 28 p. 8°.

Hale, P. M. The woods and timbers of North Carolina; a compilation from the botanical and geological reports of Drs. Curtis, Emmons, and Kerr; to which are added information obtained from the census bureau and accurate reports from the several counties. Raleigh, *Hale*. 1883. 272 p., map. 12°.

Indiana. — Department of geology and natural history. Eleventh annual report, 1881. John Collett, state geologist. Indianapolis, *State*. 1882. 414 p., 5 maps, 55 pl. 8°.

Kuhff, G. A. Les organes génitaux de l'homme et de la femme, structure et fonctions, etc. *2e éd.* Paris, *Ballière*. 1883. 64 p. 8°.

Latteux, Paul. Manuel de technique microscopique, ou Guide pratique pour l'étude et le maniement du microscope. *2e éd.* Paris, *Delahaye*, etc. 1883. 11+477 p., 177 fig. 18°.

Lecouteux, Edouard. Le blé, sa culture intensive et extensive. Paris, *imp. Chaix*. 1882. 8+413 p., 60 fig. 18°.

Marchand, Léon. Botanique cryptogamique pharmaco-médicale; programme raisonné d'un cours professé à l'école supérieure de pharmacie de Paris. Tom. i. Paris, *Doin*. 1883. 481 p. 8°.

Milne-Edwards, Alphonse. Anatomie et physiologie animales. Paris, *Masson*. 1883. 4+406 p. 311 fig. 18°.

Mortillet, Gabriel de. Le préhistorique: antiquité de l'homme (Bibl. sciences contemp.). Paris, *Reinwald*. 1883. 642 p. 8°.

New York. — Linnaean society. Transactions. Vol. i. N.Y., *Society*. 1882. 168 p., portr. l. 8°.

Niox, *Comm.* Géographie militaire. v. Europe orientale et bassin de la Méditerranée. 1e partie: péninsule des Balkans. Paris, *Baudoin*. 1882. 8+231 p. 18°.

O'Donovan, E. The Merv oasis. Travels and adventures east of the Caspian during 1879-81, including five months' residence among the Tekkés of Merv. 2 vol. N.Y. 1883. illustr. 8°.

Pharmaceutische rundschau und zeitung für die wissenschaftlichen gewerblichen interessen der pharmacie und verwandten berufs- und geschäftszweige in den Vereinigten Staaten; herausg. von Dr. Fr. Hoffmann. Bd. i. no. i. N. Y. 1883. 28 p., *m.* 4°.

Pioger, L. M. Dieu dans ses oeuvres; les splendeurs de l'astronomie, ou Il y a d'autres mondes que le nôtre. Paris, *Haton*. 1883. 18°.

La lune. 4+315 p.
Le soleil. 8+373 p.

Poitevin, A. Traité des impressions photographiques. Suivi d'appendices relatifs aux procédés, par M. Léon Vidal. *2e éd.* Paris, *Gauthier-Villars*. 1883. 14+280 p., portr. 18°.

Proctor, R. A. The great pyramid, observatory, tomb and temple. N.Y., *Worthington*. 1883. 8+323 p. illustr. 12°.

Rawlinson, G. The religions of the ancient world, including Egypt, Assyria and Babylonia, Persia, India, Phoenicia, Etruria, Greece, Rome. N.Y., *Scribner*. 1883. 12+249 p. illustr. 12°.

Rochas, Albert de. La science des philosophes et l'art des thaumaturges dans l'antiquité. Paris, *Masson*. 1883. 220 p. 24 pl. 8°.

Selvatico, Silvestro. Sur le développement embryonnaire des bombycieus. Traduction par J. Pelletan. Paris, *Doin*. 1883. 31 p., 7 pl. 8°.

Tissandier, Gaston. Les martyrs de la science. *2e éd.* Paris, *Dreyfous*. 1883. 334 p., 34 pl. 8°.

Tyndall, J. Heat as a mode of motion. *New enl. ed.* N.Y., *Appleton*. 1883. illustr. 12°.

U.S. — Corps of engineers U.S. army. Professional papers, no. 24. Primary triangulation of the lake survey; by Lieut.-Col. C. B. Comstock, U.S.A. Wash., *Government*. 1882. 920 p. 4°.

Waldmann, F. Der bernstein im alterthum; historisch-philologische skizze. Fellin. 1883. 87 p. 4°.

Wharton, W. J. L. Hydrographical surveying; a description of the means and methods employed in constructing marine charts. London. 1882. 8°.

Yung, Emile. Le sommeil normal et le sommeil pathologique; magnetisme animal, hypnotisme, névrose hystérique. (Bibl. biol. intern.) Paris, *Doin*. 1883. 196 p. 18°.